EXHIBIT I

Exhibit A-27
Invalidity Claim Chart for U.S. Patent No. 7,924,802 vs. U.S. Patent No. 8,693,525

U.S. Patent No. 8,693,525 ("Rick") was filed on July 12, 2007, published on January 17, 2008 (U.S. Patent Application No. 2008/0013639), and issued on April 8, 2014. Rick anticipates asserted claims 1–4, 6–10, 13, 14, 17, and 21–24 of U.S. Patent No. 7,924,802 ("the '802 Patent") under 35 U.S.C. § 102. Rick also renders obvious asserted claims 1–4, 6–10, 13, 14, 17, and 21–24 of the '802 Patent under 35 U.S.C. § 103, alone based on the state of the art and/or in combination with one or more other references identified in Exs. A-1–A-31, Cover Pleading, and First Supplemental Ex. A-Obviousness Chart.[1]

To the extent Plaintiff alleges that Rick does not disclose any particular limitation of the asserted claims in the '802 Patent, either expressly or inherently, it would have been obvious to a person of ordinary skill in the art as of the priority date of the '802 Patent to modify Rick and/or to combine the teachings of Rick with other prior art references, including but not limited to the present prior art references found in Exs. A-1–A-31, Cover Pleading, First Supplemental Ex. A-Obviousness Chart, and the relevant section of charts for other prior art for the '802 Patent in a manner that would render the asserted claims of these patents invalid as obvious.

With respect to the obviousness of the asserted claims of the '802 Patent under 35 U.S.C. § 103, one or more of the principles enumerated by the United States Supreme Court in *KSR v. Teleflex*, 550 U.S. 398 (2007) apply, including: (a) combining various claimed elements known in the prior art according to known methods to yield a predictable result; and/or (b) making a simple substitution of one or more known elements for another to obtain a predictable result; and/or (c) using a known technique to improve a similar device or method in the same way; and/or (d) applying a known technique to a known device or method ready for improvement to yield a predictable result; and/or (e) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success or, in other words, the solution was one which was "obvious to try"; and/or (f) a known work in one field of endeavor prompting variations of it for use either in the same field or a different field based on given design incentives or other market forces in which the variations were predictable to one of ordinary skill in the art; and/or (g) a teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine the teachings of various prior art references to arrive at the claimed invention. It therefore would have been obvious to one of ordinary skill in the art to combine the disclosures of these references in accordance with the principles and rationales set forth above.

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[1] Samsung is investigating this prior art and has not yet completed discovery from third parties, who may have relevant information concerning the prior art, and therefore, Samsung reserves the right to supplement this chart after additional discovery is received. To the extent that any of the prior art discloses the same or similar functionality or feature(s) of any of the accused products, Samsung reserves the right to argue that said feature or functionality does not practice any limitation of any of the asserted claims, and to argue, in the alternative, that if said feature or functionality is found to practice any limitation of any of the asserted claims in the '802 Patent, then the prior art reference teaches the limitation and that the claim is not patentable.

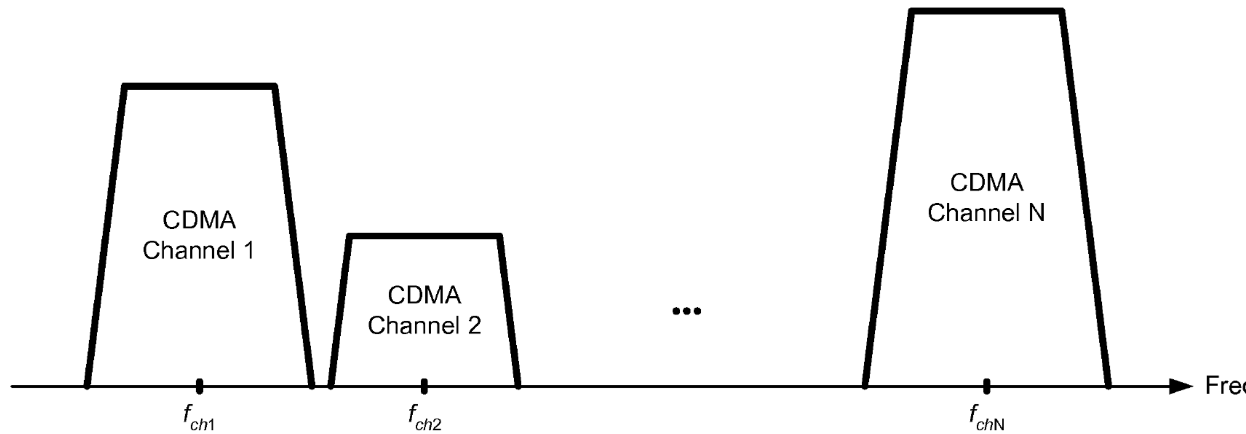
The citations to portions of any reference in this chart are exemplary only. For example, a citation that refers to or discusses a figure or figure item should be understood to also incorporate by reference that figure and any additional descriptions of that figure as if set forth fully therein. Samsung reserves the right to rely on the entirety of the references cited in this chart to show that the asserted claims of the '802 Patent are invalid. Citations presented for one claim limitation are expressly incorporated by reference into all other limitations for that claim as well as all limitations of all claims on which that claim depends. Samsung also reserves the right to rely on additional citations or sources of evidence that also may be applicable, or that may become applicable in light of claim construction, changes in Plaintiff's infringement contentions, and/or information obtained during discovery as the case progresses.

Claim 1 of the '802 Patent	**Prior Art Reference – Rick**
[1.1] A method of transmitting information in a wireless communication channel comprising:	To the extent the preamble is limiting, Rick discloses "A method of transmitting information in a wireless communication channel comprising." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time

Claim 1 of the ’802 Patent	Prior Art Reference – Rick
	Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

Claim 1 of the ’802 Patent	**Prior Art Reference – Rick**
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 1 of the ’802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47.

Claim 1 of the ’802 Patent	**Prior Art Reference – Rick**
	 ***FIG. 1*** *See, e.g.*, Rick at Figure 1. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[1.2] transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first	Rick discloses “transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one

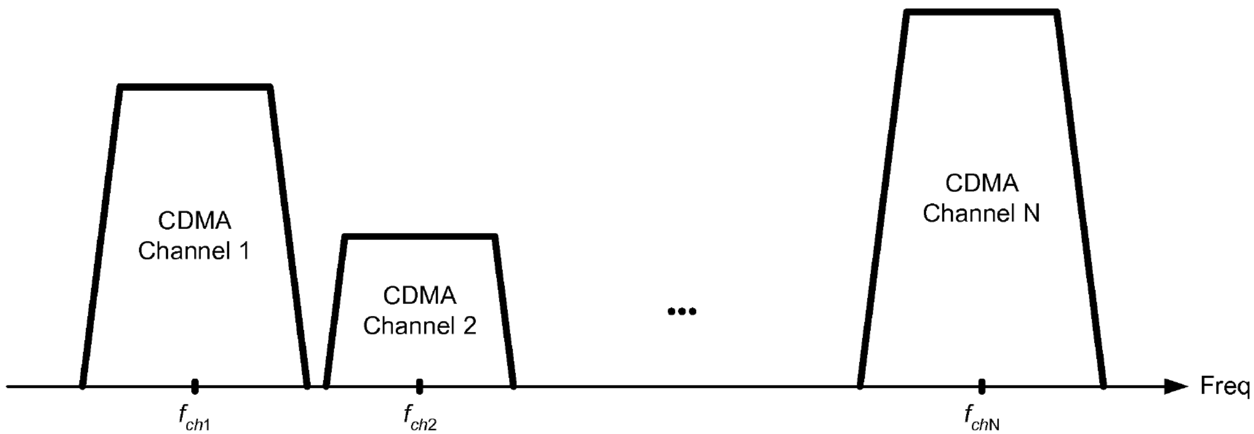
Claim 1 of the '802 Patent	Prior Art Reference – Rick
highest frequency, and a first lowest frequency; and	processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF

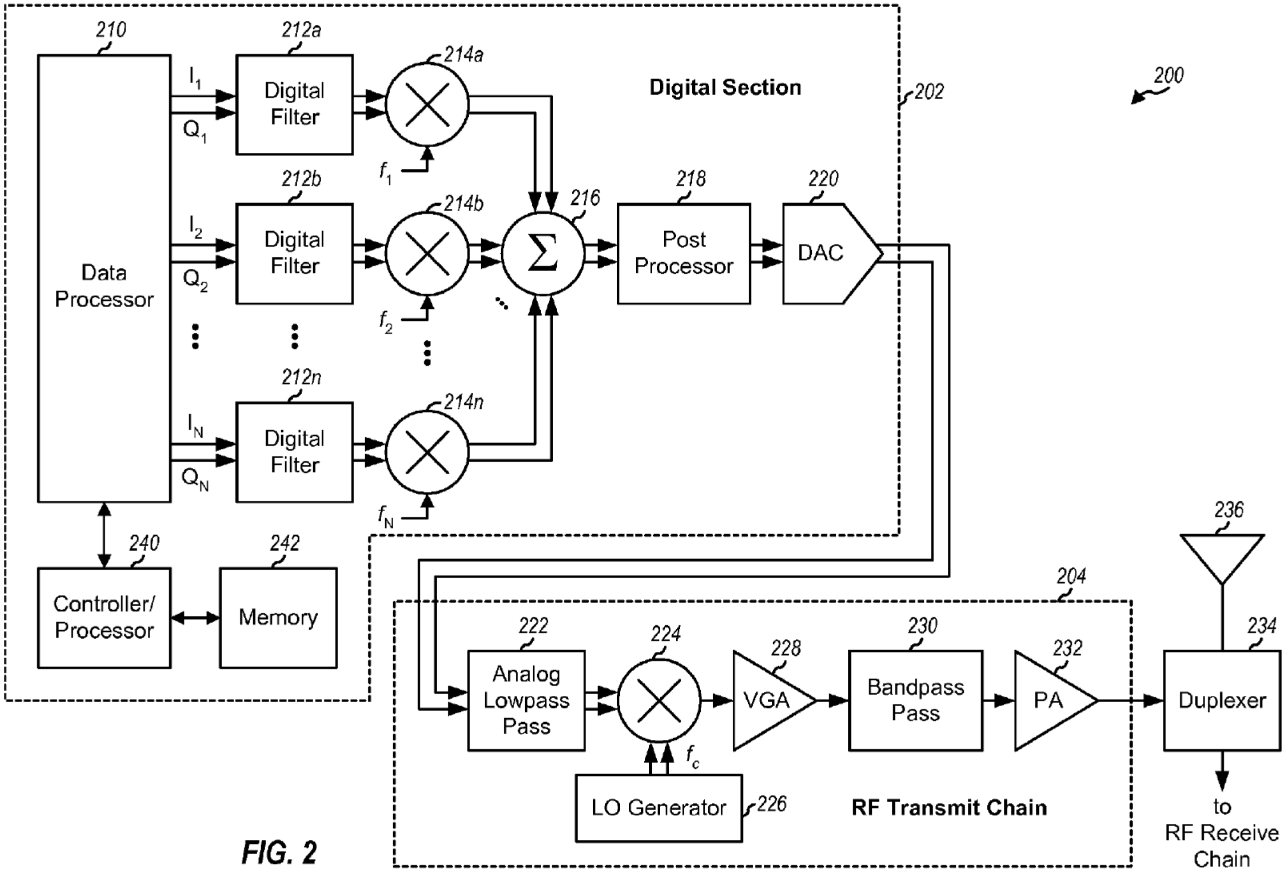
Claim 1 of the '802 Patent	Prior Art Reference – Rick
	transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is

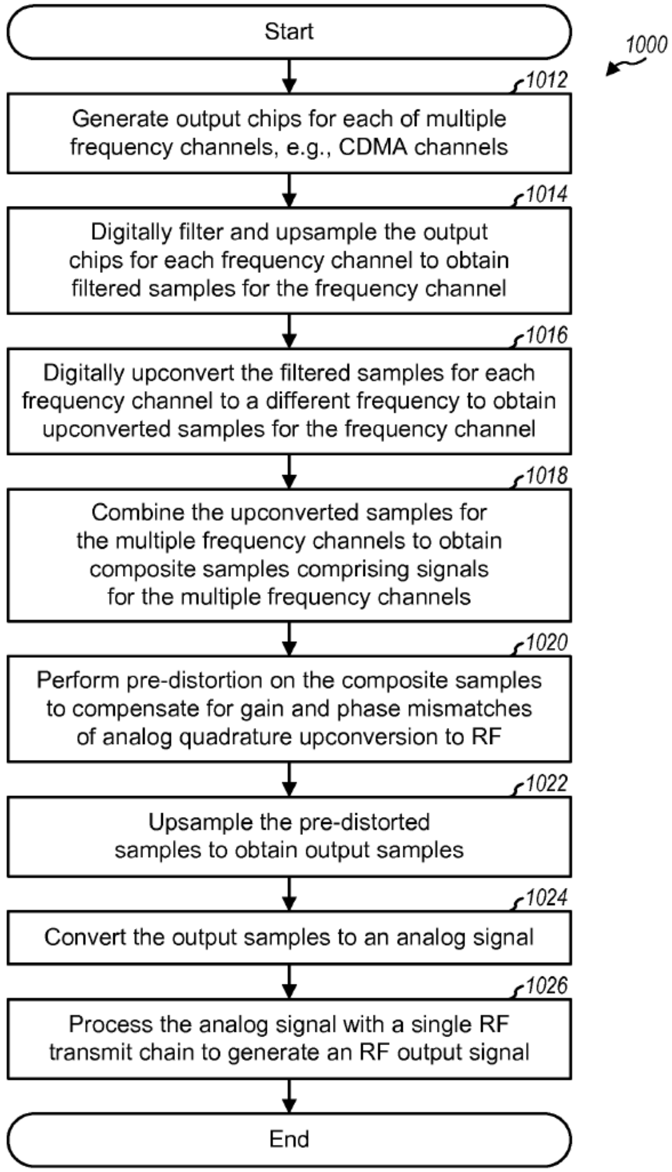
Claim 1 of the '802 Patent	Prior Art Reference – Rick
	described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where $N \geqq 1$ in general and $N>1$ for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data,

Claim 1 of the '802 Patent	Prior Art Reference – Rick
	text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals.

Claim 1 of the ’802 Patent	Prior Art Reference – Rick
	An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band.

Claim 1 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.  FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 1 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

	Start 1000 1012 Generate output chips for each of multiple frequency channels, e.g., CDMA channels 1014 Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel 1016 Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel 1018 Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels 1020 Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF 1022 Upsample the pre-distorted samples to obtain output samples 1024 Convert the output samples to an analog signal 1026 Process the analog signal with a single RF transmit chain to generate an RF output signal End FIG. 10

Claim 1 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[1.3] simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.	Rick discloses “simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access

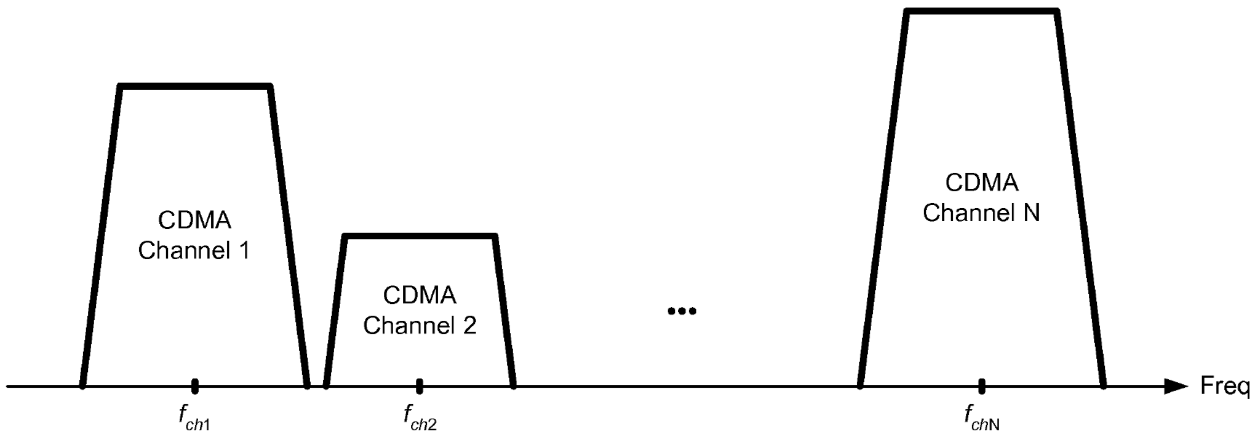
Claim 1 of the ’802 Patent	**Prior Art Reference – Rick**
	systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output

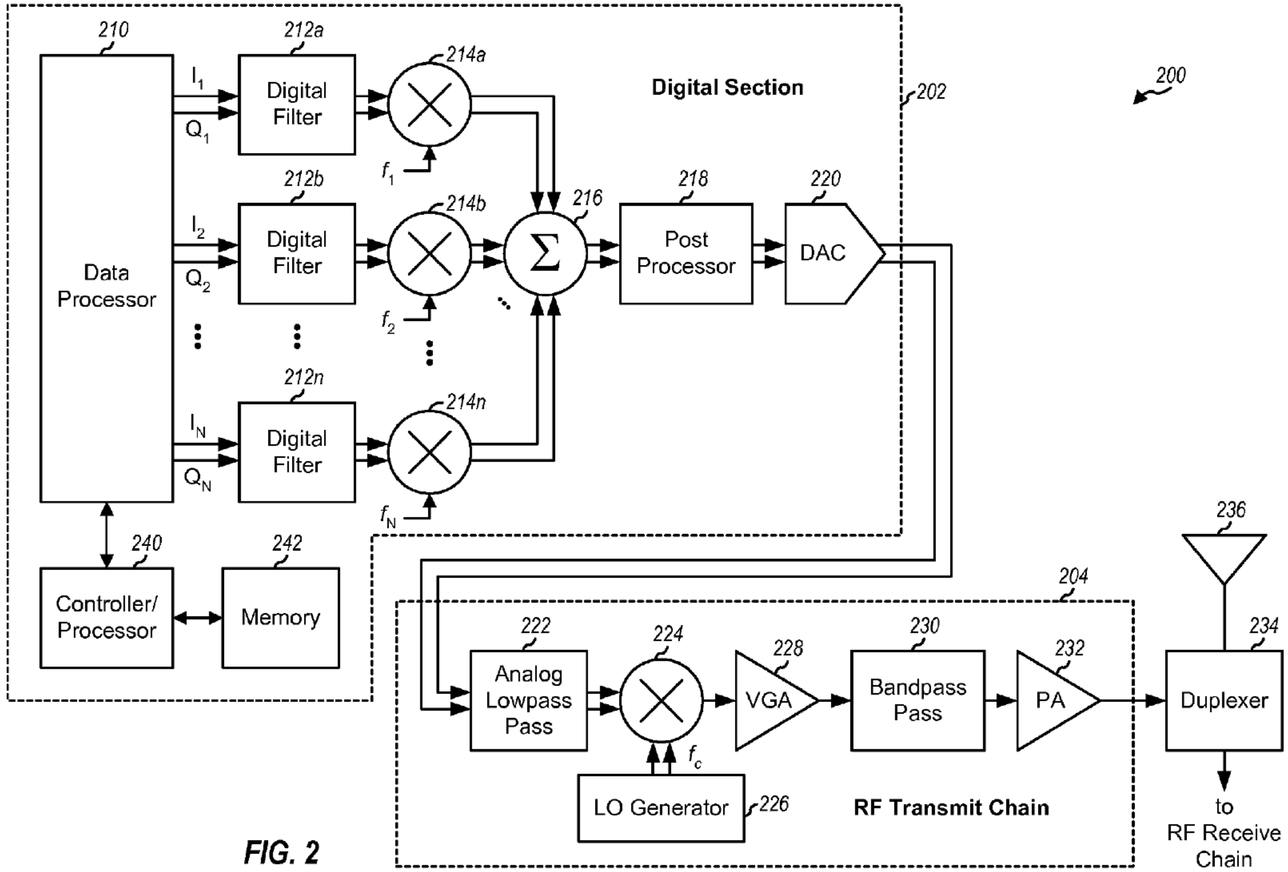
Claim 1 of the '802 Patent	Prior Art Reference – Rick
	samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below.

Claim 1 of the '802 Patent	Prior Art Reference – Rick
	The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system.

Claim 1 of the '802 Patent	Prior Art Reference – Rick
	Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal

Claim 1 of the ’802 Patent	Prior Art Reference – Rick
	from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 1 of the ’802 Patent	Prior Art Reference – Rick
	 ***FIG. 1*** *See, e.g.*, Rick at Figure 1.

Claim 1 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

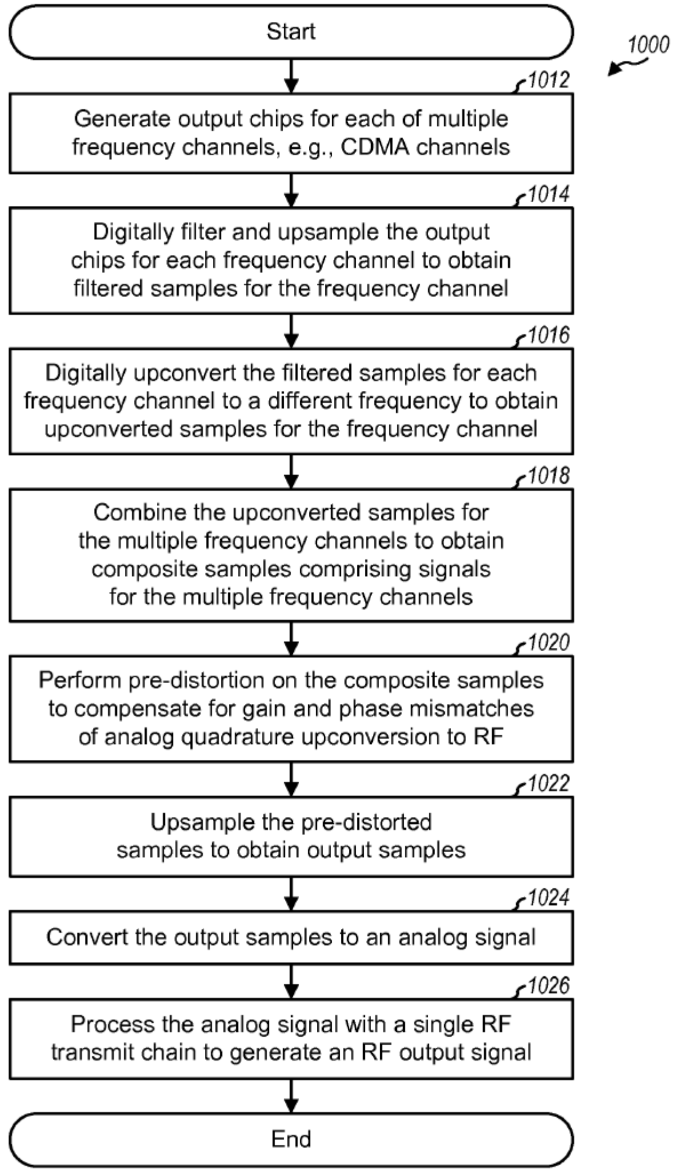

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 1 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 2 of the ’802 Patent	Prior Art Reference – Rick
[2.1] The method of claim 1	Rick discloses all the elements of claim 1 for all the reasons provided above.
[2.2] wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.	Rick discloses “wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal.

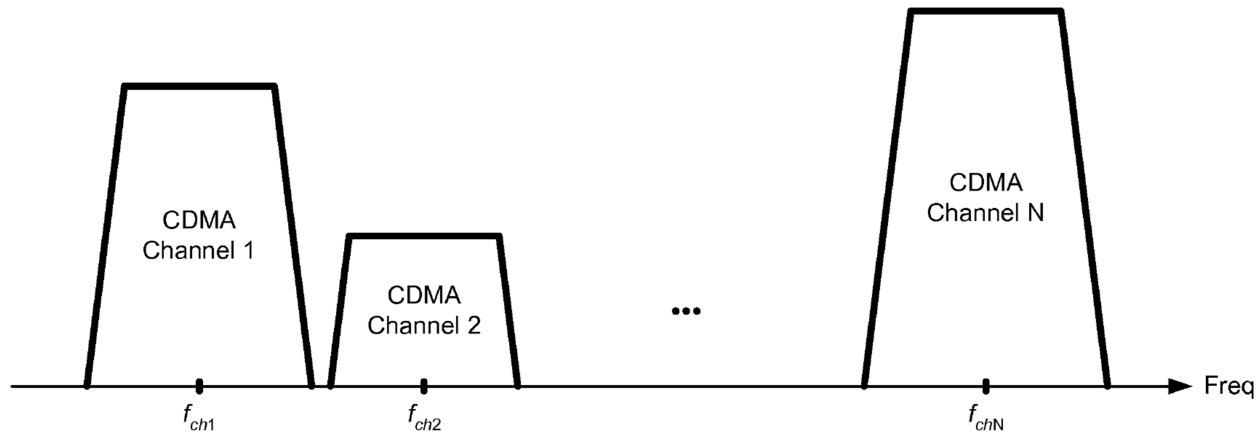
Claim 2 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each

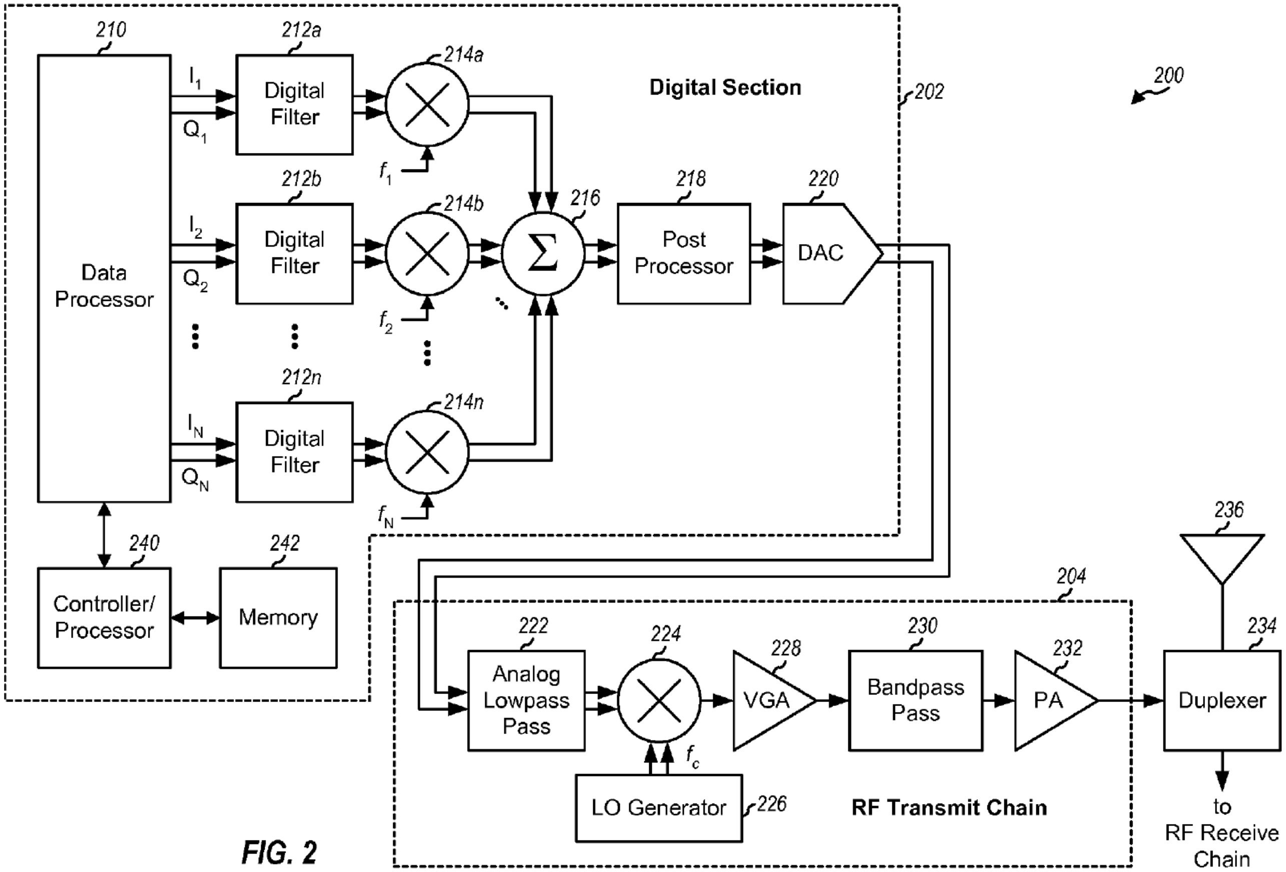
Claim 2 of the ’802 Patent	Prior Art Reference – Rick
	frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

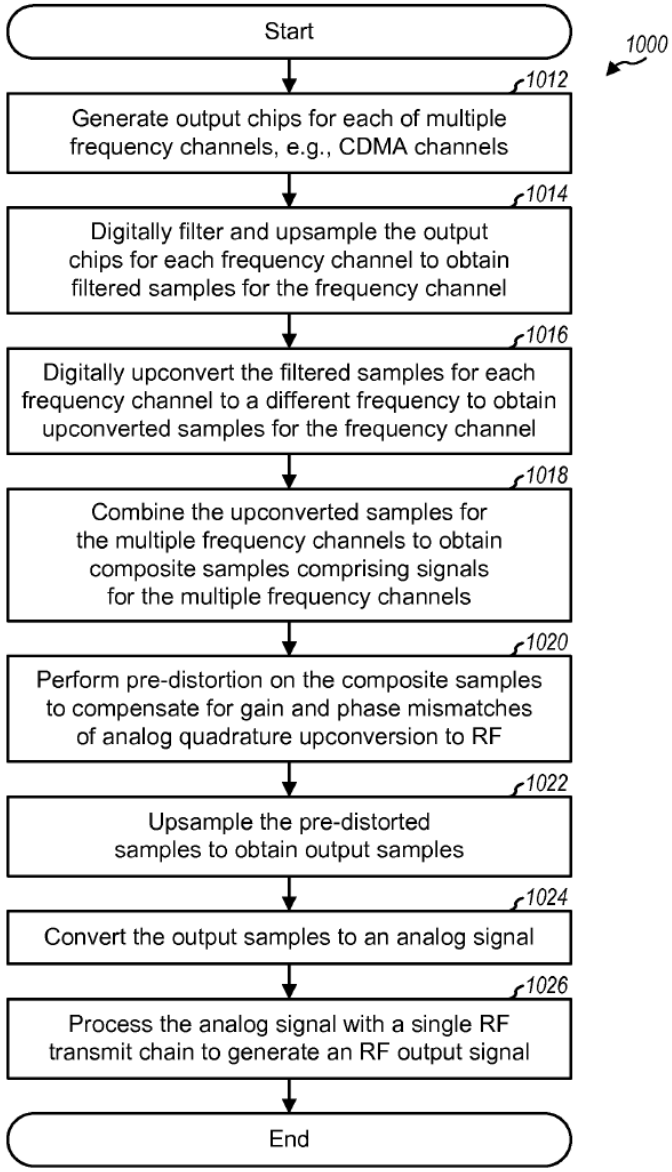
Claim 2 of the ’802 Patent	**Prior Art Reference – Rick**
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 2 of the '802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 2 of the '802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 2 of the ’802 Patent	Prior Art Reference – Rick
	 **FIG. 1** *See, e.g.*, Rick at Figure 1.

Claim 2 of the '802 Patent	**Prior Art Reference – Rick**
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

	Start 1000 1012 Generate output chips for each of multiple frequency channels, e.g., CDMA channels 1014 Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel 1016 Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel 1018 Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels 1020 Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF 1022 Upsample the pre-distorted samples to obtain output samples 1024 Convert the output samples to an analog signal 1026 Process the analog signal with a single RF transmit chain to generate an RF output signal End FIG. 10

Claim 2 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 3 of the ’802 Patent	Prior Art Reference – Rick
[3.1] The method of claim 1	Rick discloses all the elements of claim 1 for all the reasons provided above.
[3.2] wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.	Rick discloses “wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

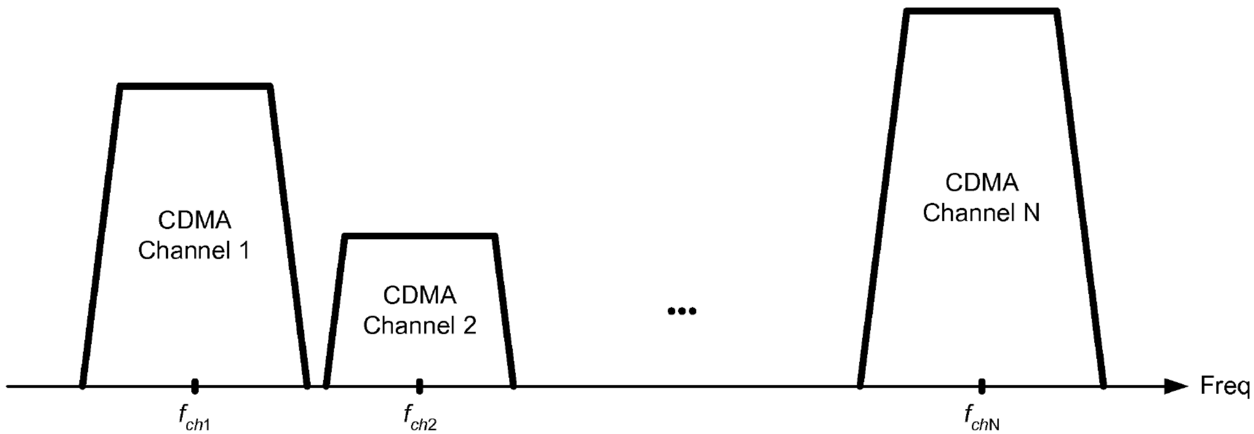
Claim 3 of the ’802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

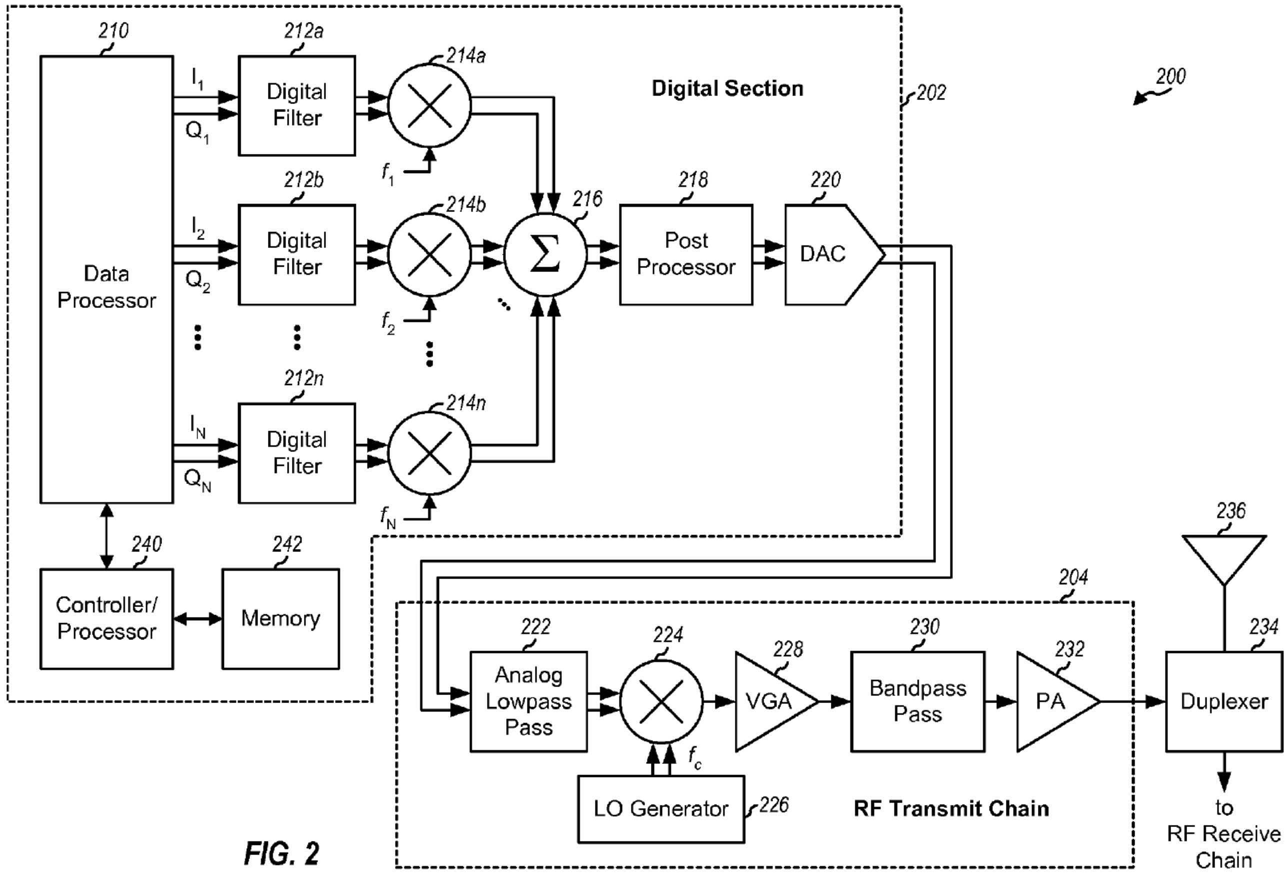
Claim 3 of the ’802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

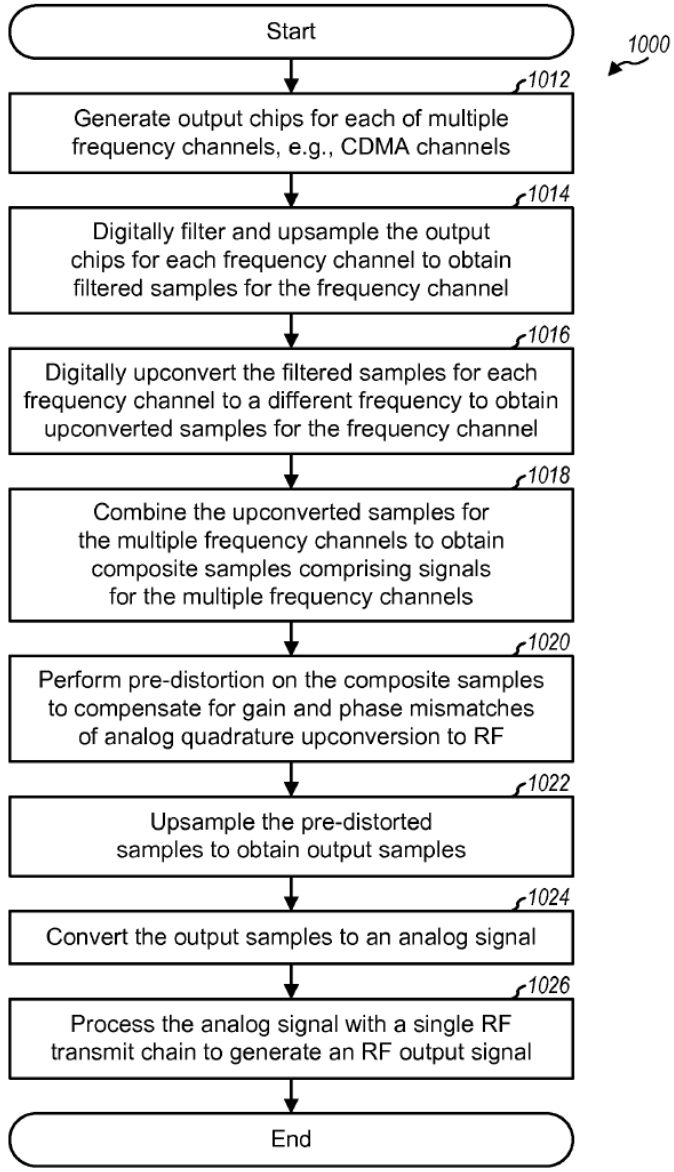
Claim 3 of the ’802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N$\geqq$1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 3 of the ’802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analo g LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 3 of the '802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 3 of the ’802 Patent	**Prior Art Reference – Rick**
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 3 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 3 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 4 of the '802 Patent	Prior Art Reference – Rick
[4.1] The method of claim 3	Rick discloses all the elements of claim 3 for all the reasons provided above.
[4.2] wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.	Rick discloses "wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

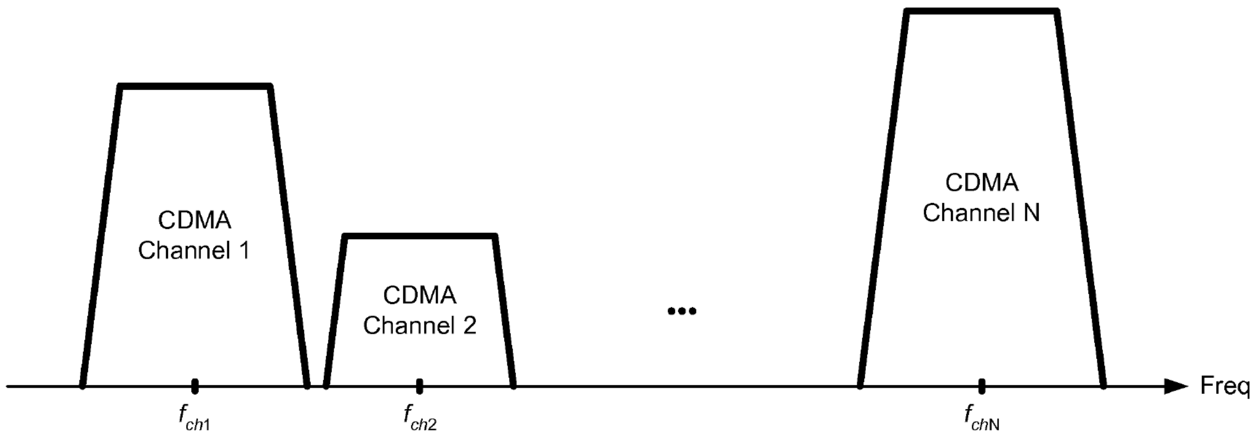
Claim 4 of the '802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

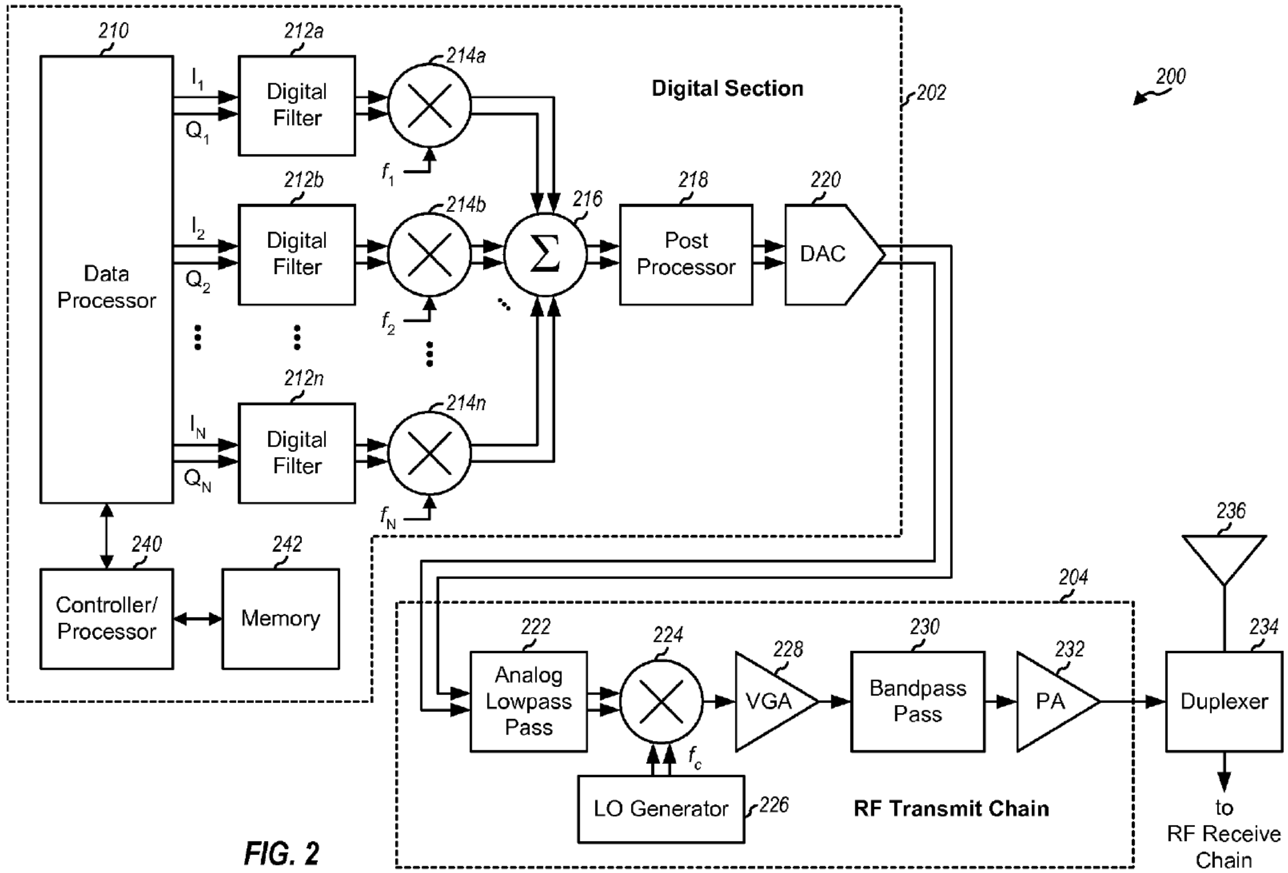
Claim 4 of the ’802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 4 of the ’802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 4 of the '802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 4 of the ’802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See*, *e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See*, *e.g.*, Rick at 5:24-30.

Claim 4 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 4 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

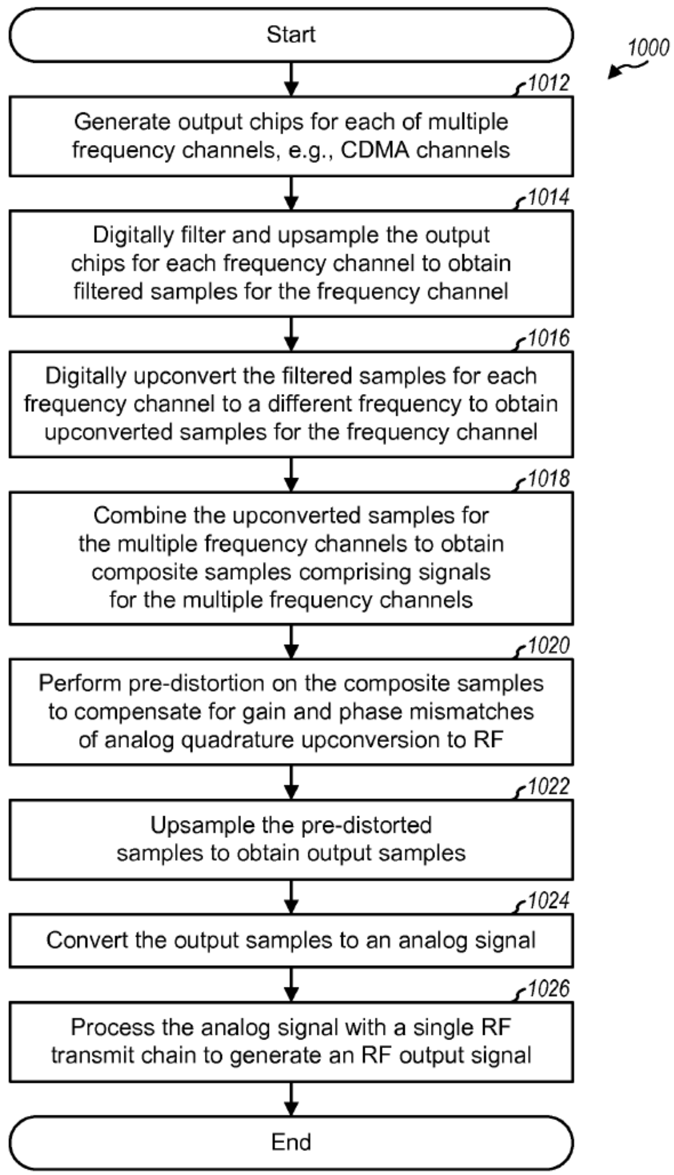

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 4 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 6 of the ’802 Patent	Prior Art Reference – Rick
[6.1] The method of claim 1	Rick discloses all the elements of claim 1 for all the reasons provided above.
[6.2] wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol.	Rick discloses “wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

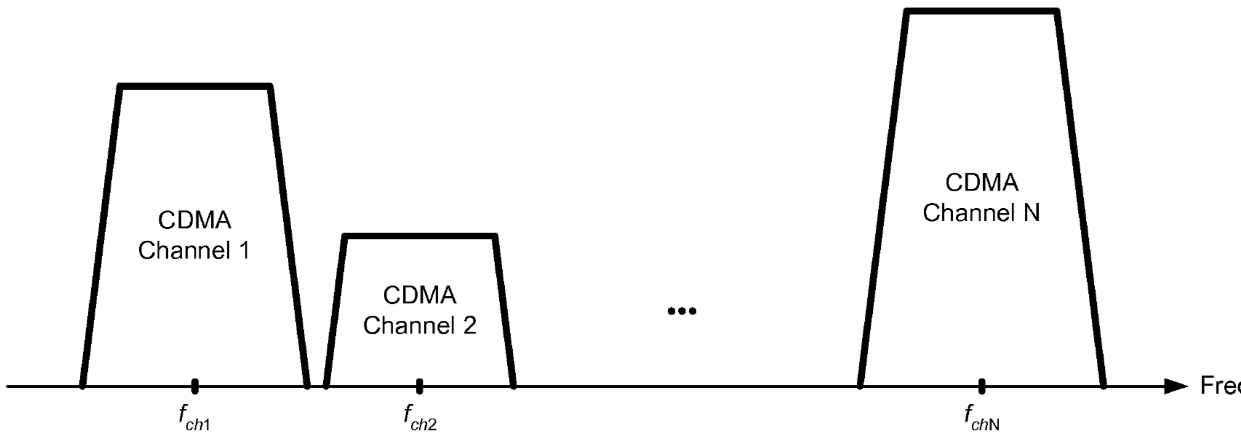
Claim 6 of the ’802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

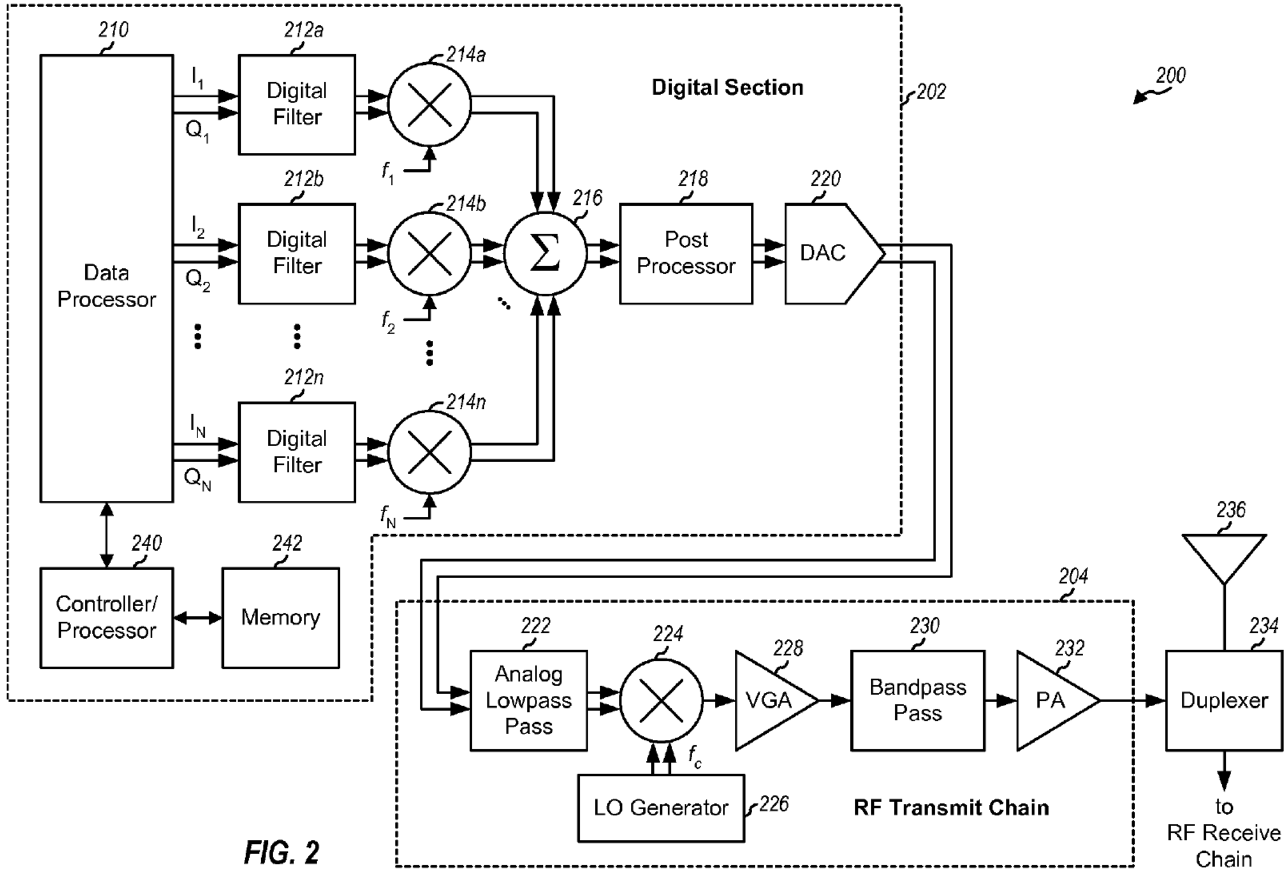
Claim 6 of the '802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 6 of the '802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 6 of the '802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 6 of the '802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 6 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 6 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

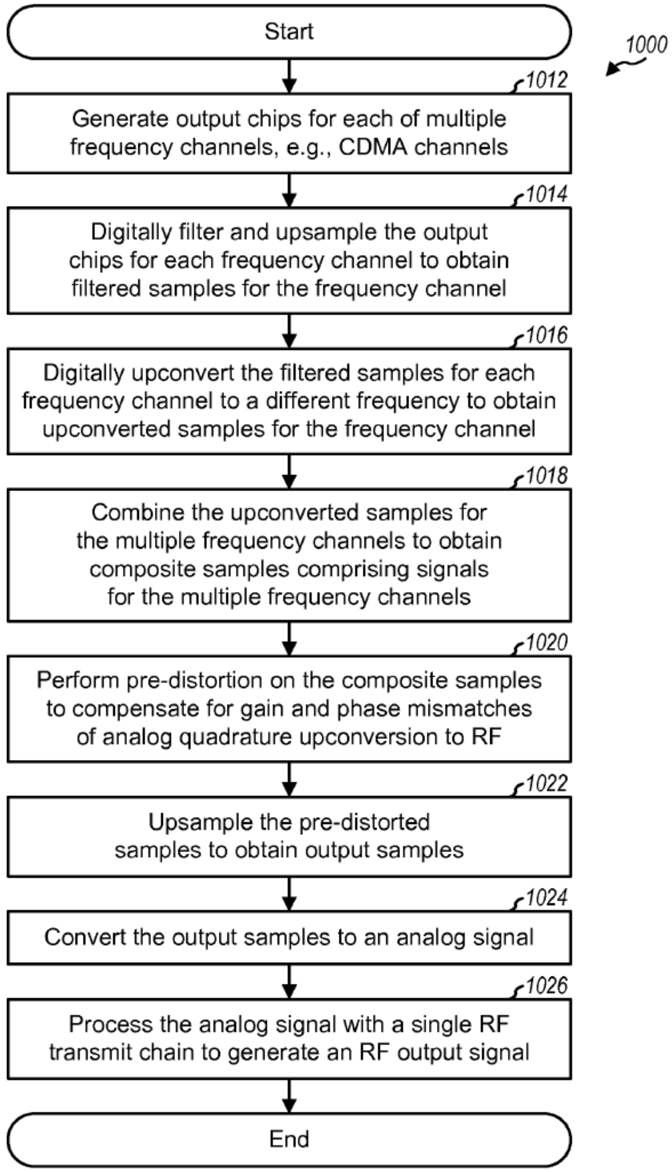

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 6 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 7 of the ’802 Patent	Prior Art Reference – Rick
[7.1] The method of claim 1	Rick discloses all the elements of claim 1 for all the reasons provided above.
[7.2] wherein the first information and the second information are the same data transmitted across two different frequencies.	Rick discloses “wherein the first information and the second information are the same data transmitted across two different frequencies.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

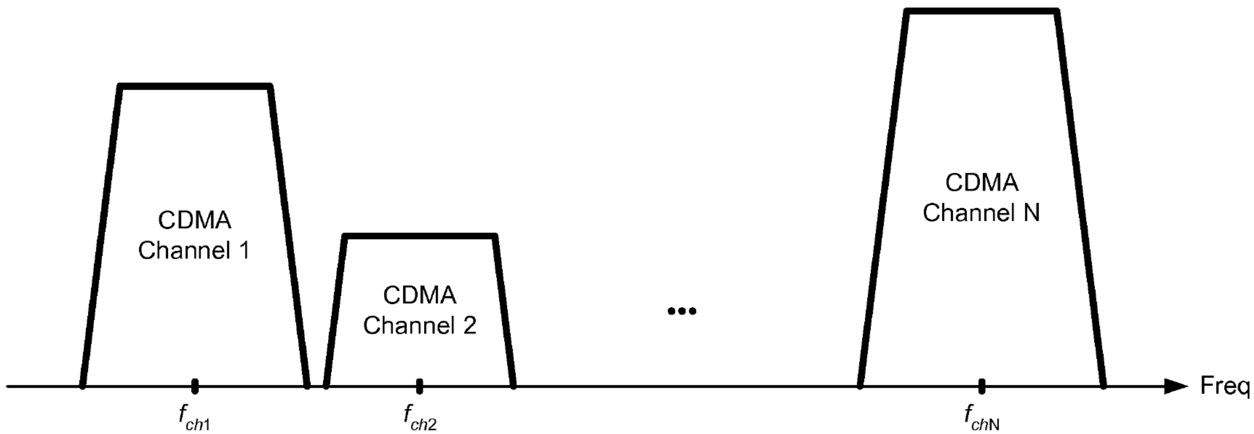
Claim 7 of the '802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

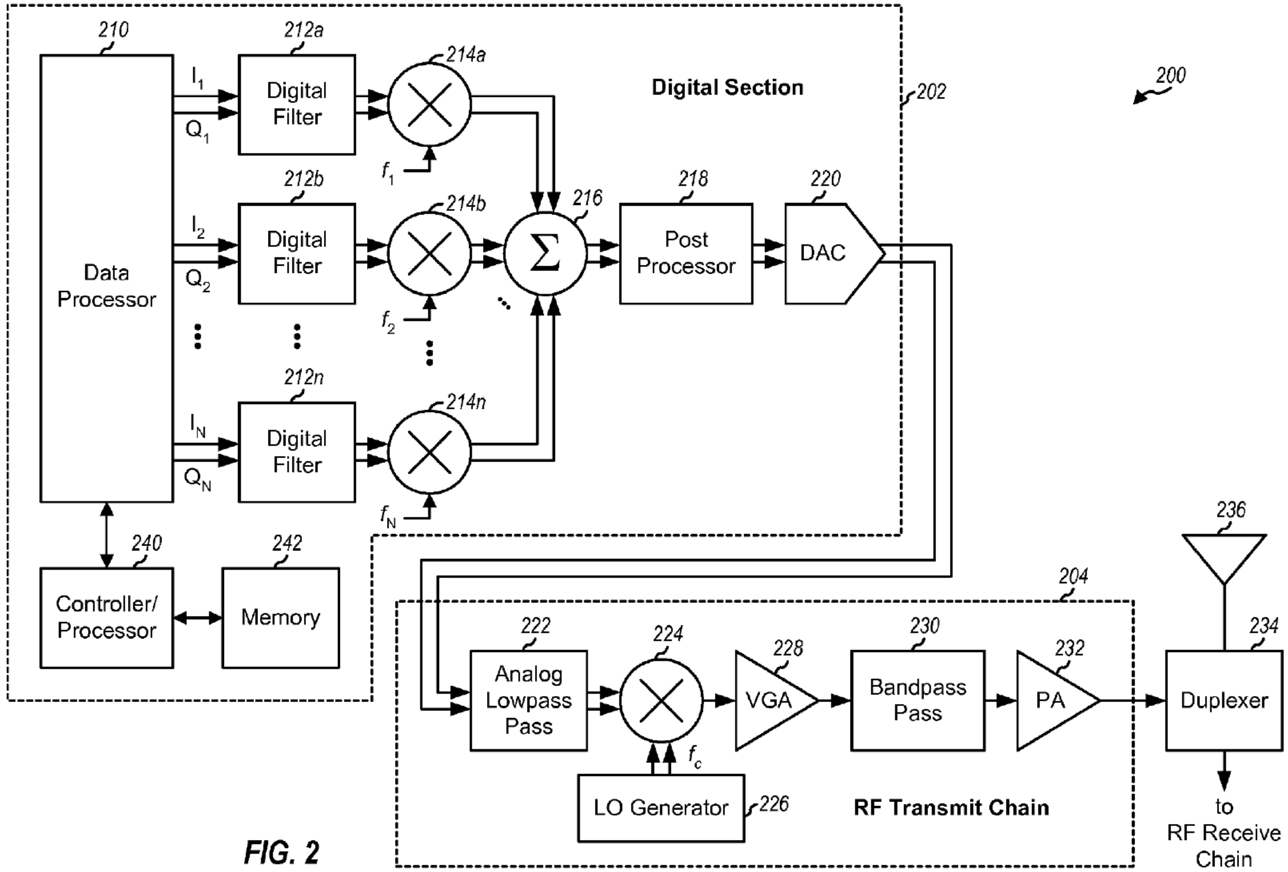
Claim 7 of the '802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 7 of the ’802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 7 of the '802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 7 of the '802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 7 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 7 of the ’802 Patent	Prior Art Reference – Rick
	 *FIG. 2* *See, e.g.*, Rick at Figure 2.

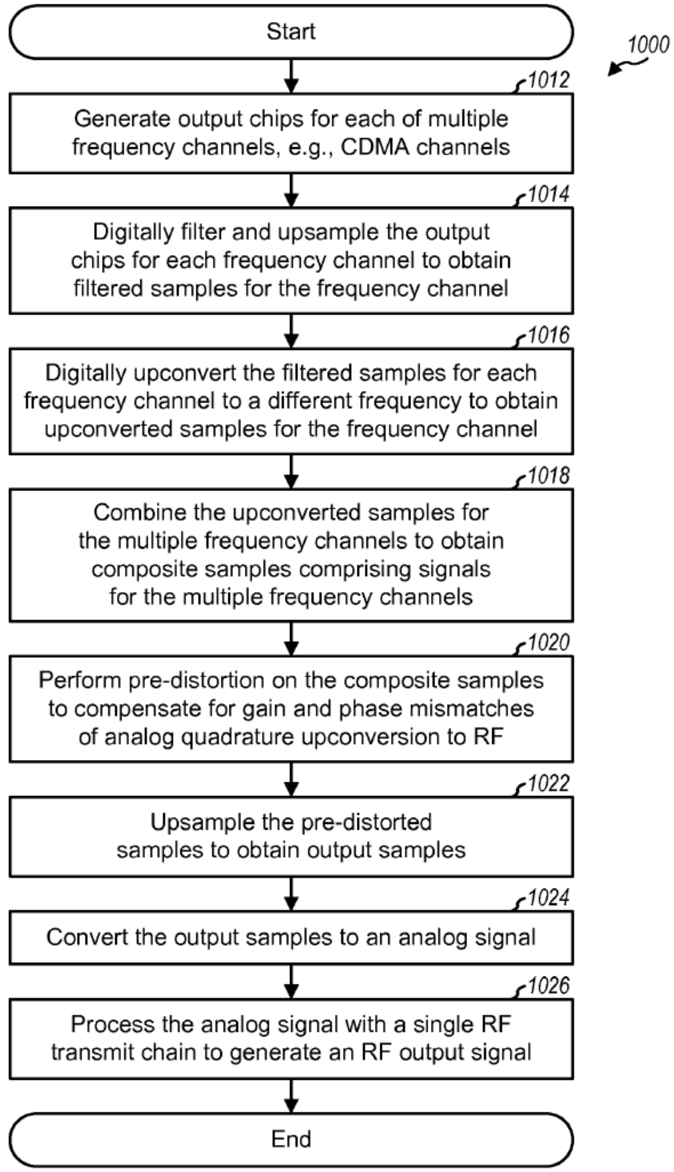

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 7 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 8 of the ’802 Patent	**Prior Art Reference – Rick**
[8.1] The method of claim 1	Rick discloses all the elements of claim 1 for all the reasons provided above.
[8.2] wherein the first information and the second information are from the same data stream.	Rick discloses “wherein the first information and the second information are from the same data stream.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

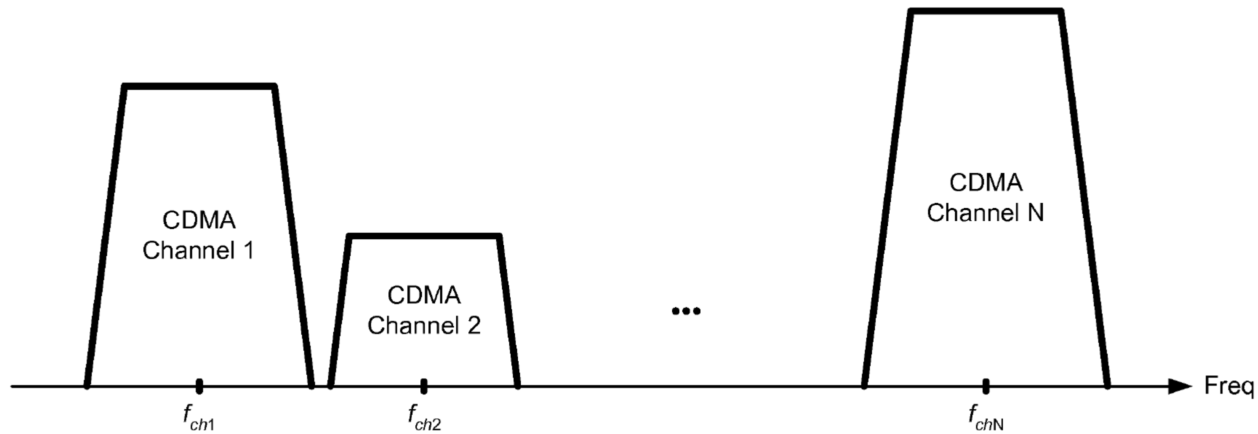
Claim 8 of the ’802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

Claim 8 of the '802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 8 of the '802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47.

Claim 8 of the '802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 8 of the '802 Patent	**Prior Art Reference – Rick**
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 8 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

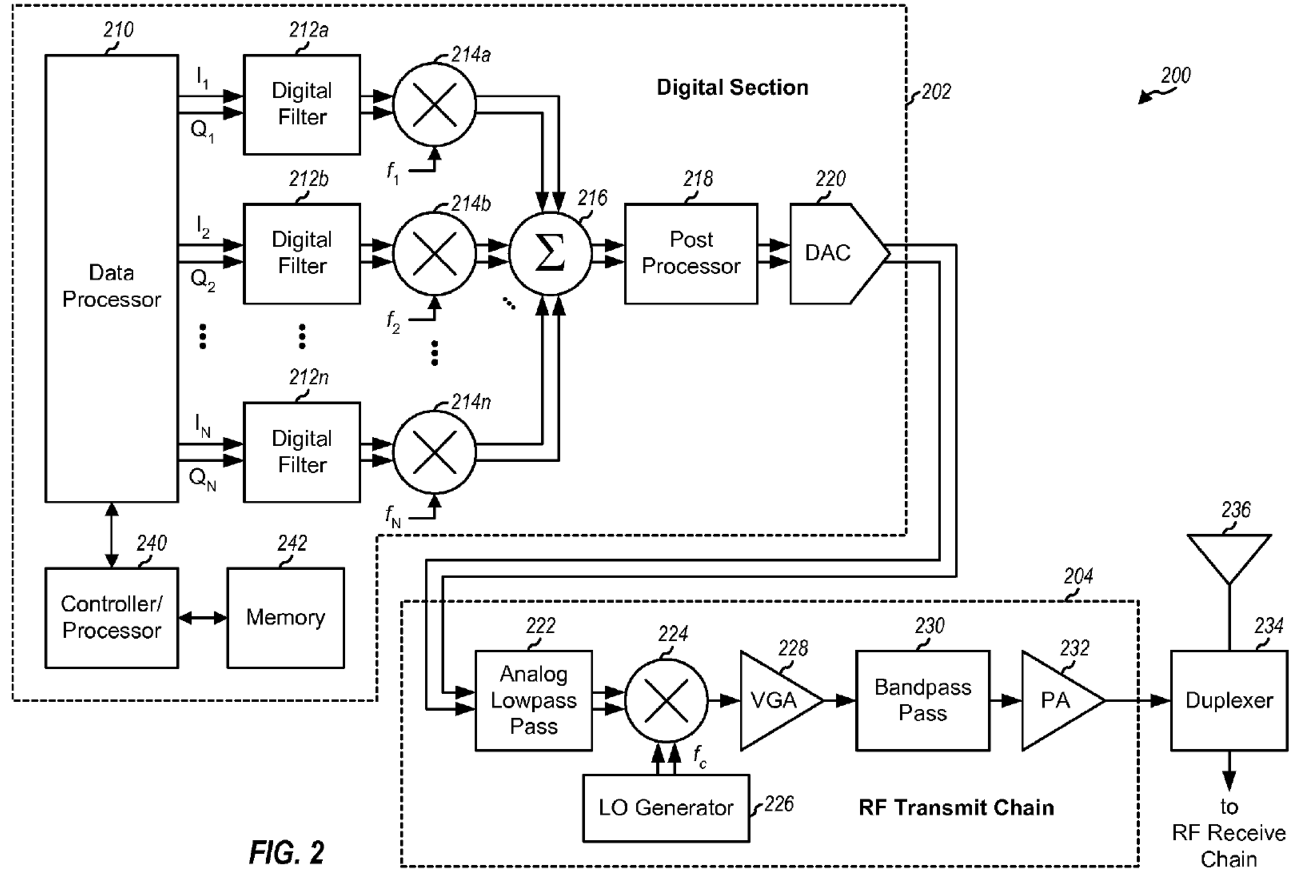
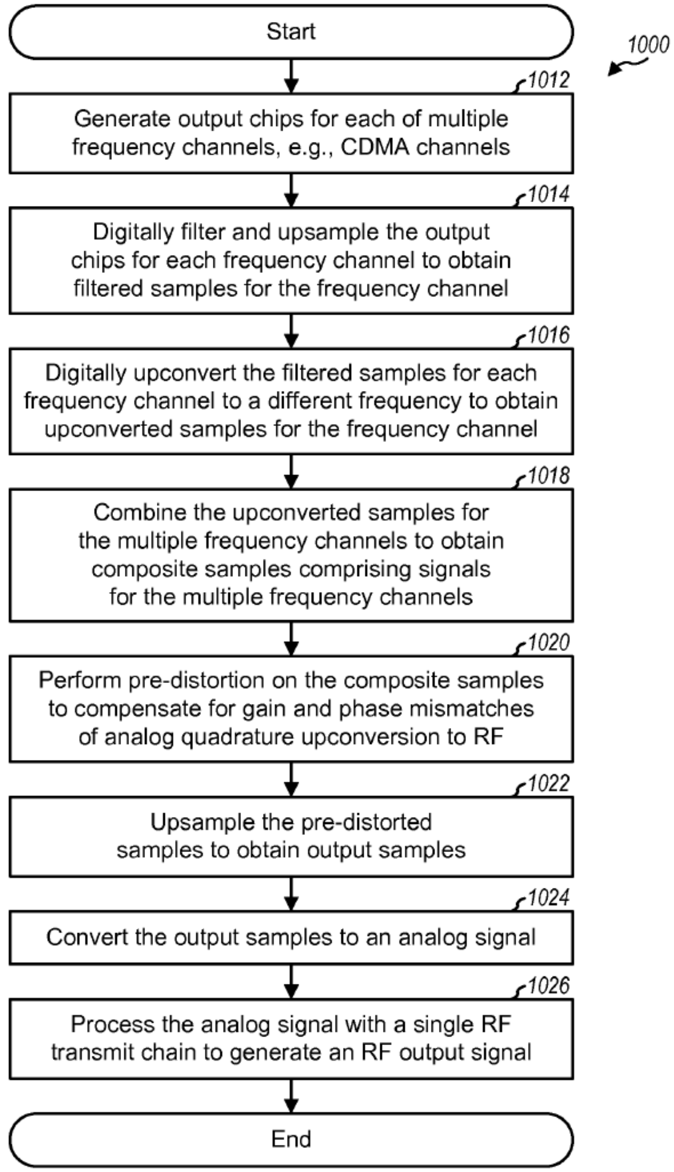
<table>
<tr><th>Claim 8 of the ’802 Patent</th><th>Prior Art Reference – Rick</th></tr>
<tr><td></td><td>

FIG. 2

See, *e.g.*, Rick at Figure 2.</td></tr>
</table>

	Start 1000 1012 Generate output chips for each of multiple frequency channels, e.g., CDMA channels 1014 Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel 1016 Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel 1018 Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels 1020 Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF 1022 Upsample the pre-distorted samples to obtain output samples 1024 Convert the output samples to an analog signal 1026 Process the analog signal with a single RF transmit chain to generate an RF output signal End FIG. 10

Claim 8 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 9 of the ’802 Patent	Prior Art Reference – Rick
[9.1] The method of claim 1	Rick discloses all the elements of claim 1 for all the reasons provided above.
[9.2] wherein first information and second information comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during	Rick discloses “wherein first information and second information comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog

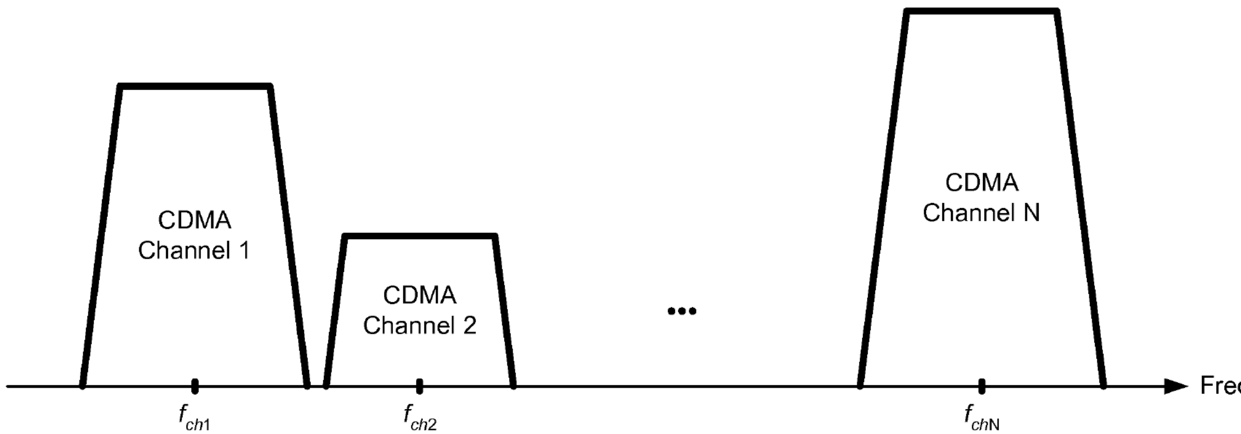
Claim 9 of the ’802 Patent	Prior Art Reference – Rick
the second time slot across a second frequency range.	signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each

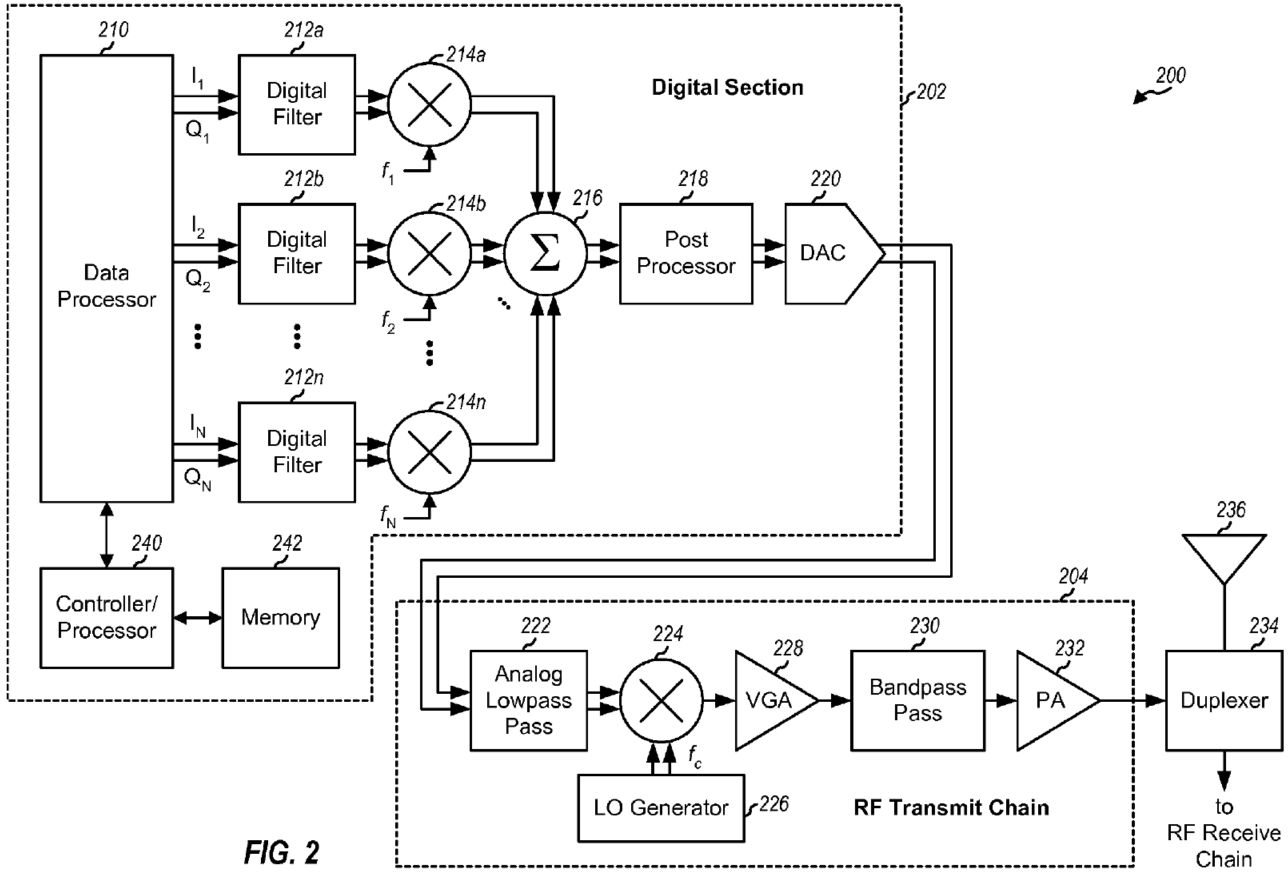
Claim 9 of the ’802 Patent	Prior Art Reference – Rick
	frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or

Claim 9 of the '802 Patent	Prior Art Reference – Rick
	mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where $N \geqq 1$ in general and $N>1$ for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal.

Claim 9 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture.

Claim 9 of the ’802 Patent	Prior Art Reference – Rick
	Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 9 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 9 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

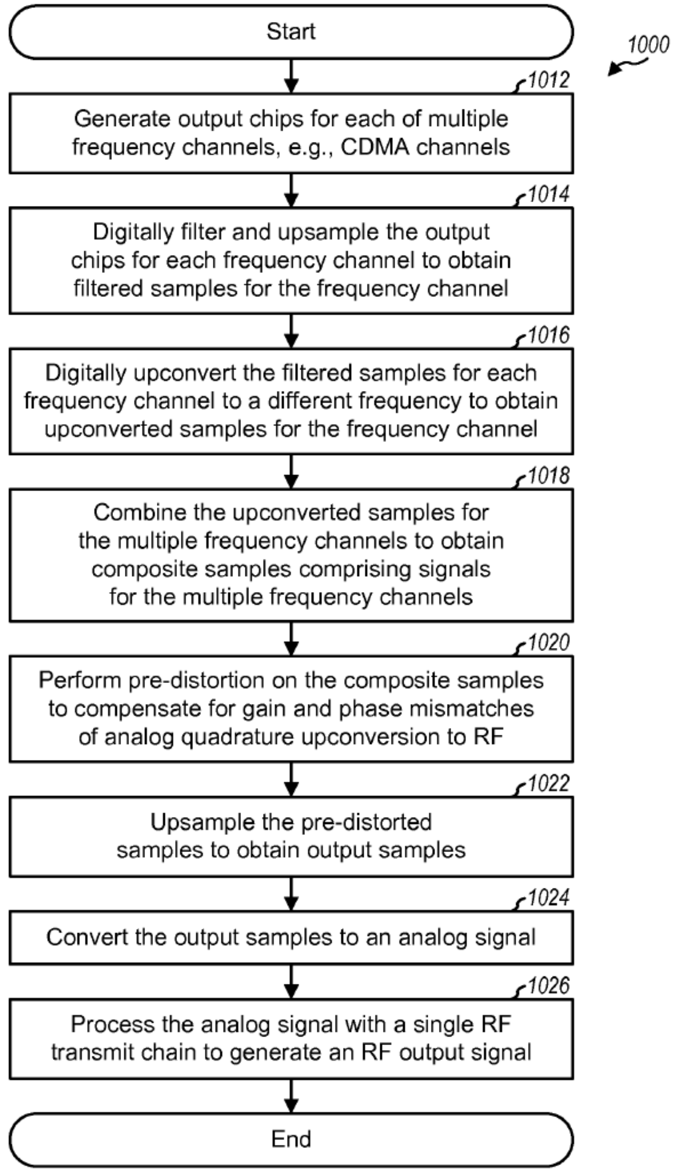

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 9 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
[10.1] A method of transmitting information in a wireless communication channel comprising:	To the extent the preamble is limiting, Rick discloses “A method of transmitting information in a wireless communication channel comprising.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.2] receiving a first digital signal comprising first data to be transmitted;	Rick discloses “receiving a first digital signal comprising first data to be transmitted.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems.

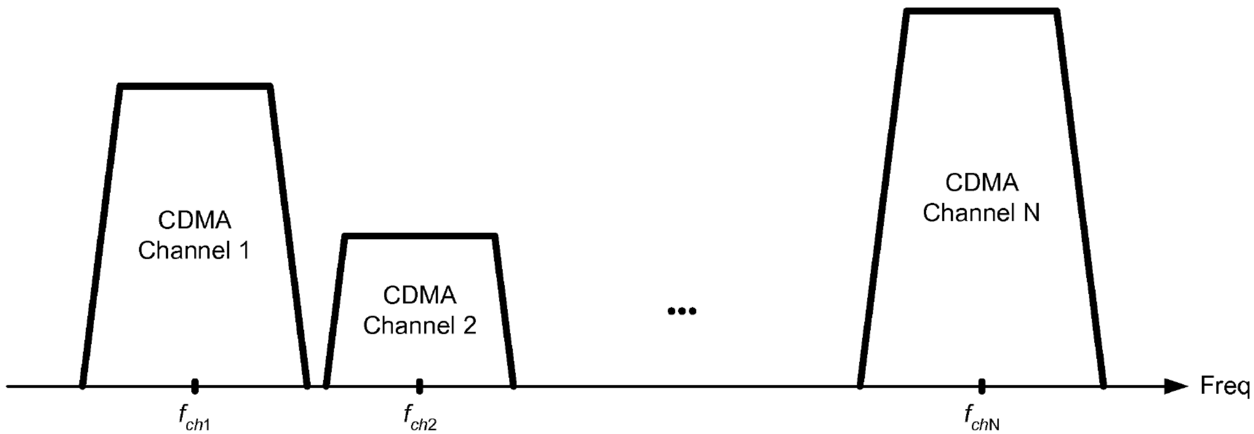
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9.

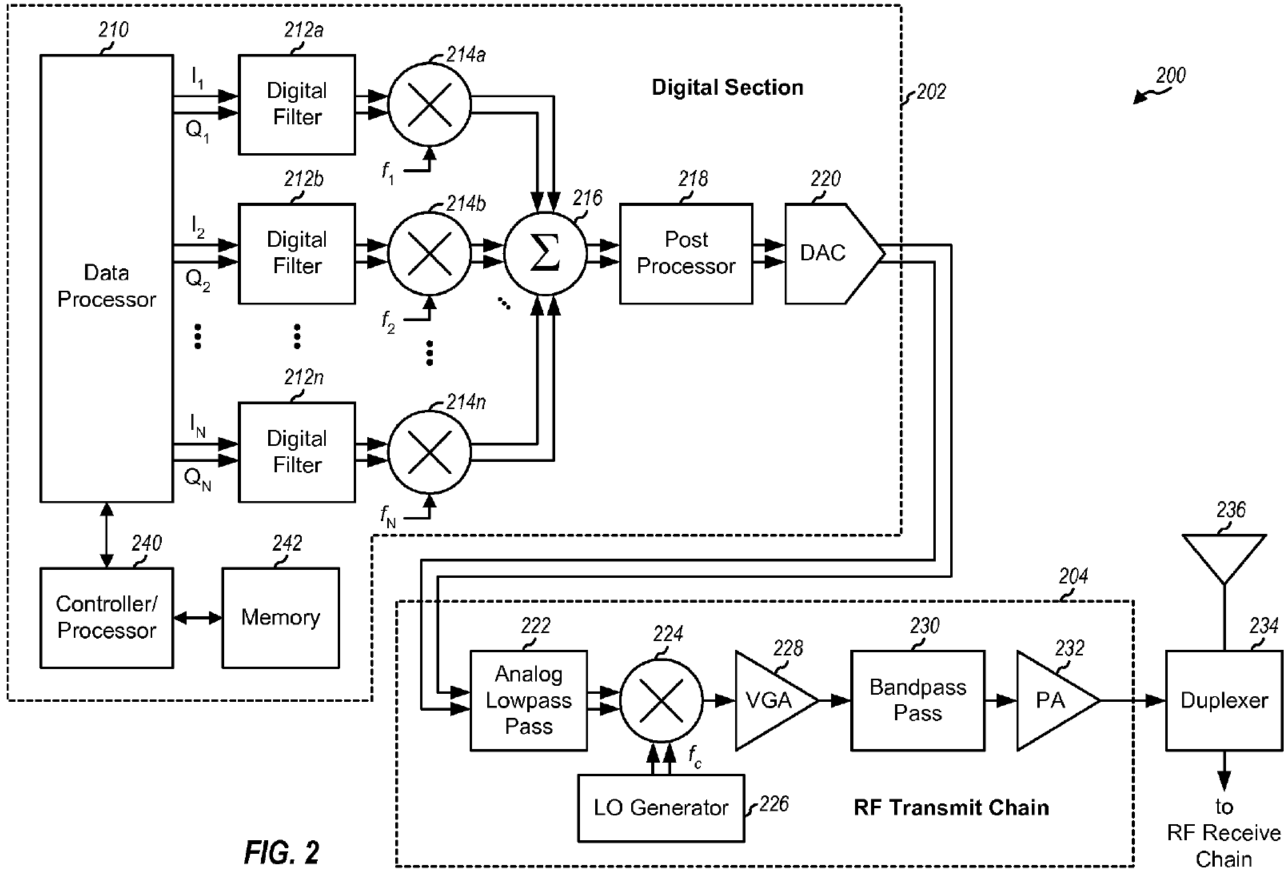
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier.

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See*, *e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See*, *e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

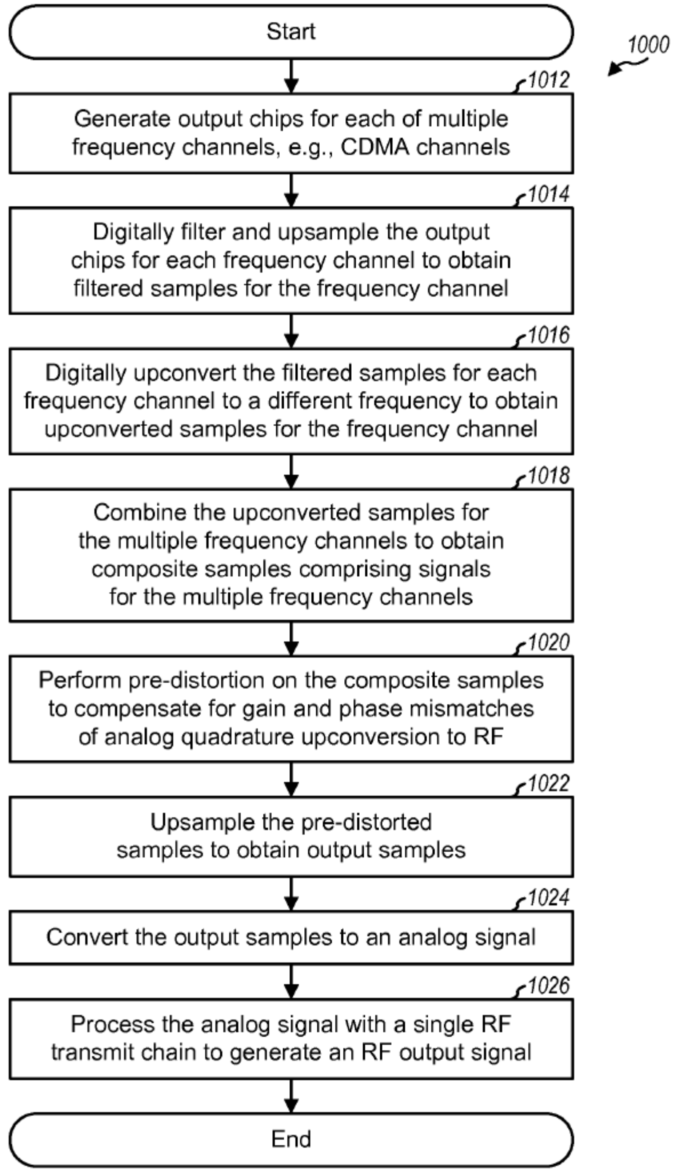

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.3] receiving a second digital signal comprising second data to be transmitted;	Rick discloses “receiving a second digital signal comprising second data to be transmitted.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time

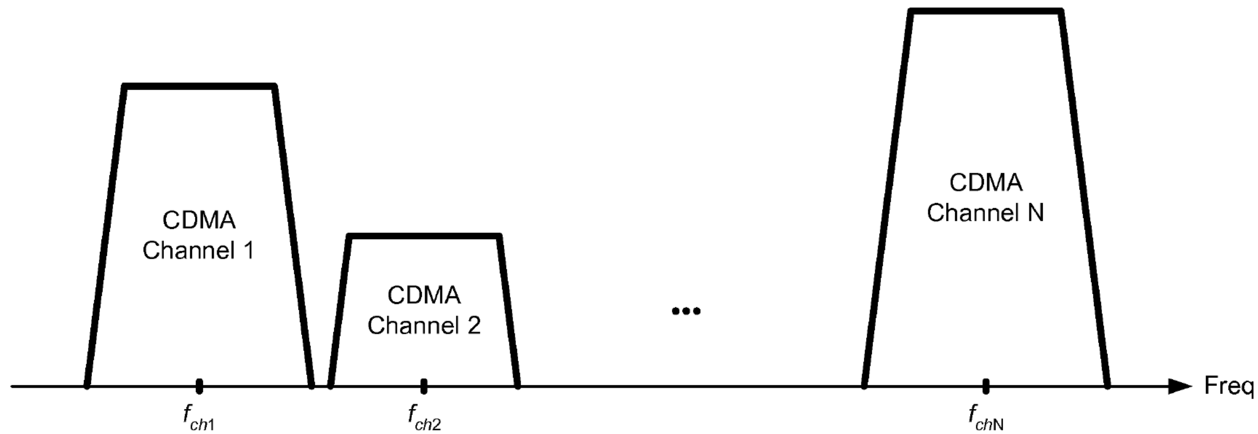
Claim 10 of the '802 Patent	Prior Art Reference – Rick
	Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

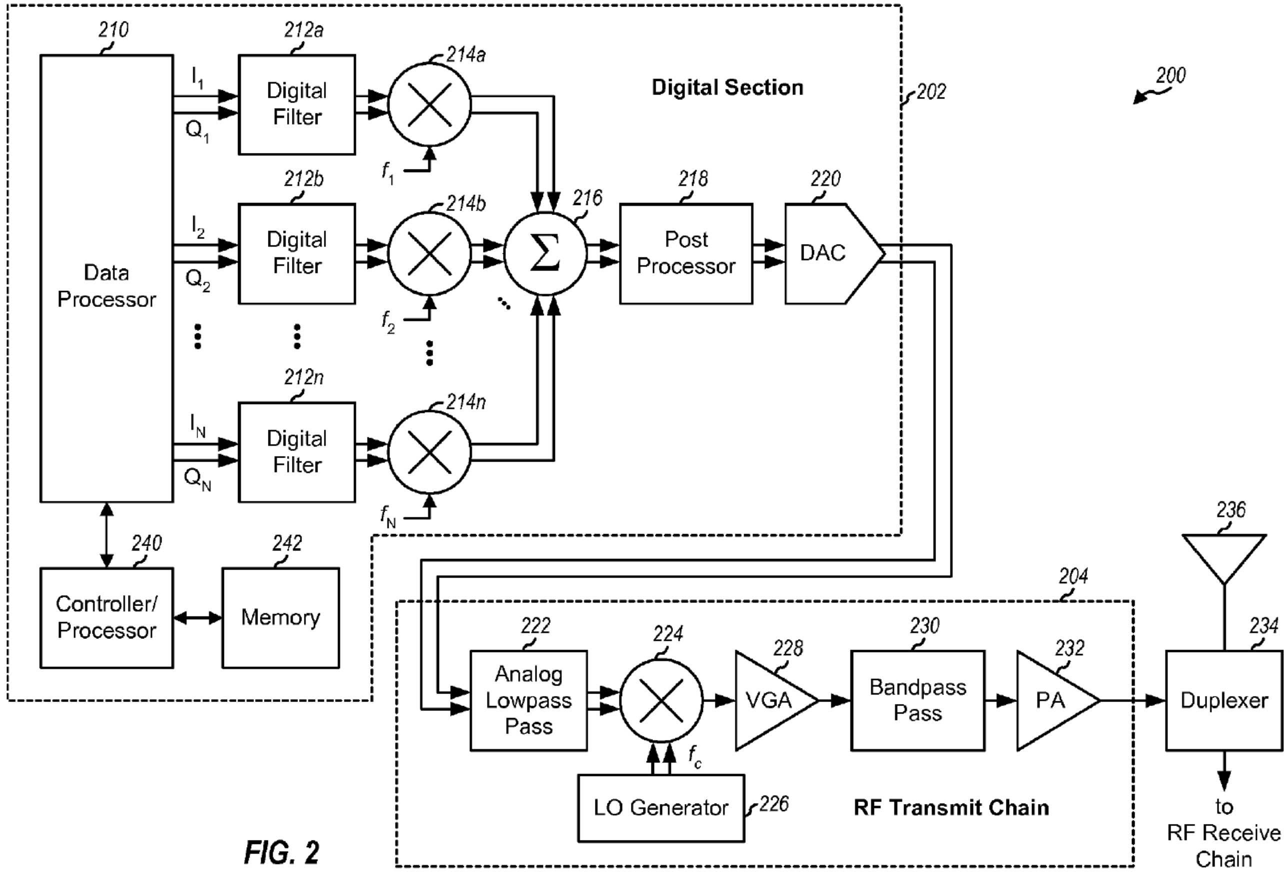
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 *FIG. 2* *See, e.g.*, Rick at Figure 2.

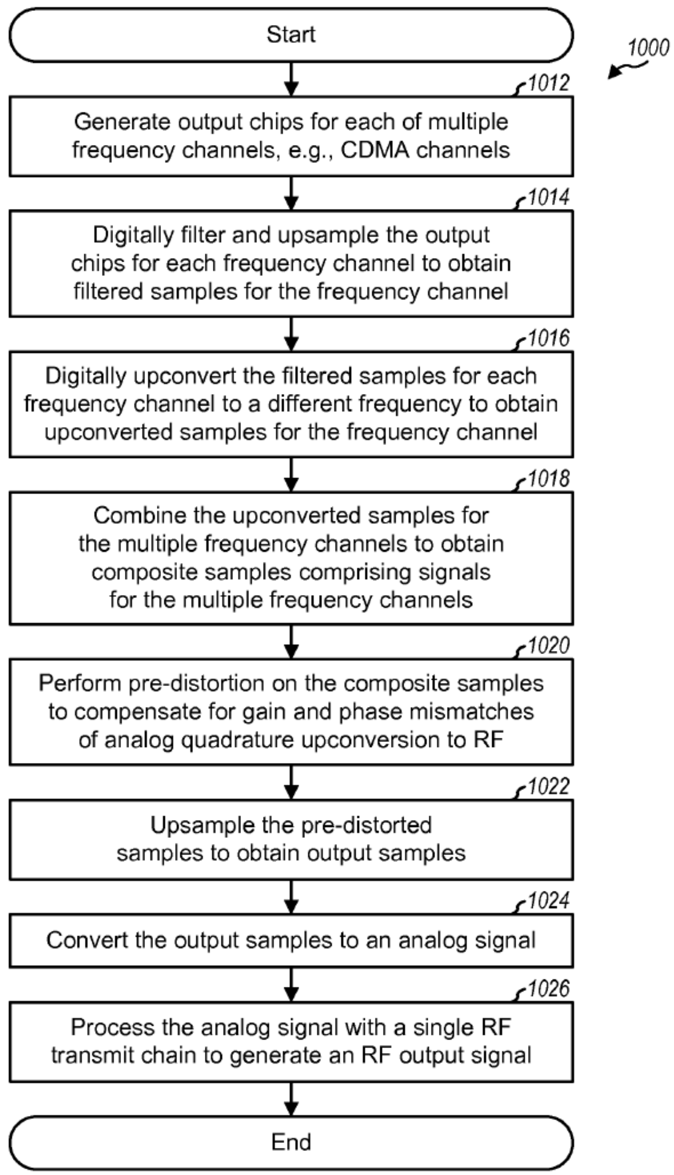

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.4] converting the first digital signal into a first analog signal using a first digital-to-analog converter, the first analog signal carrying the first data across a first frequency range;.	Rick discloses “converting the first digital signal into a first analog signal using a first digital-to-analog converter, the first analog signal carrying the first data across a first frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

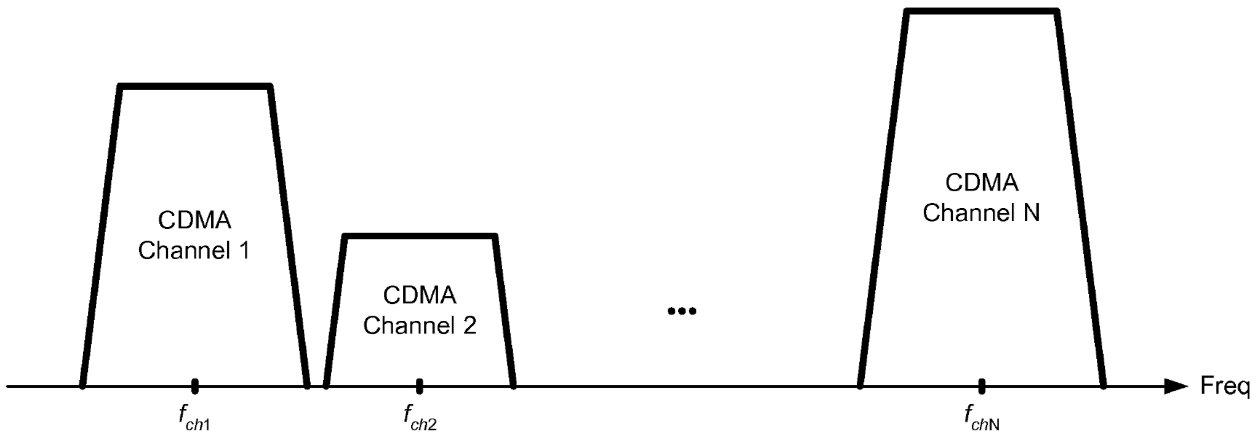
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

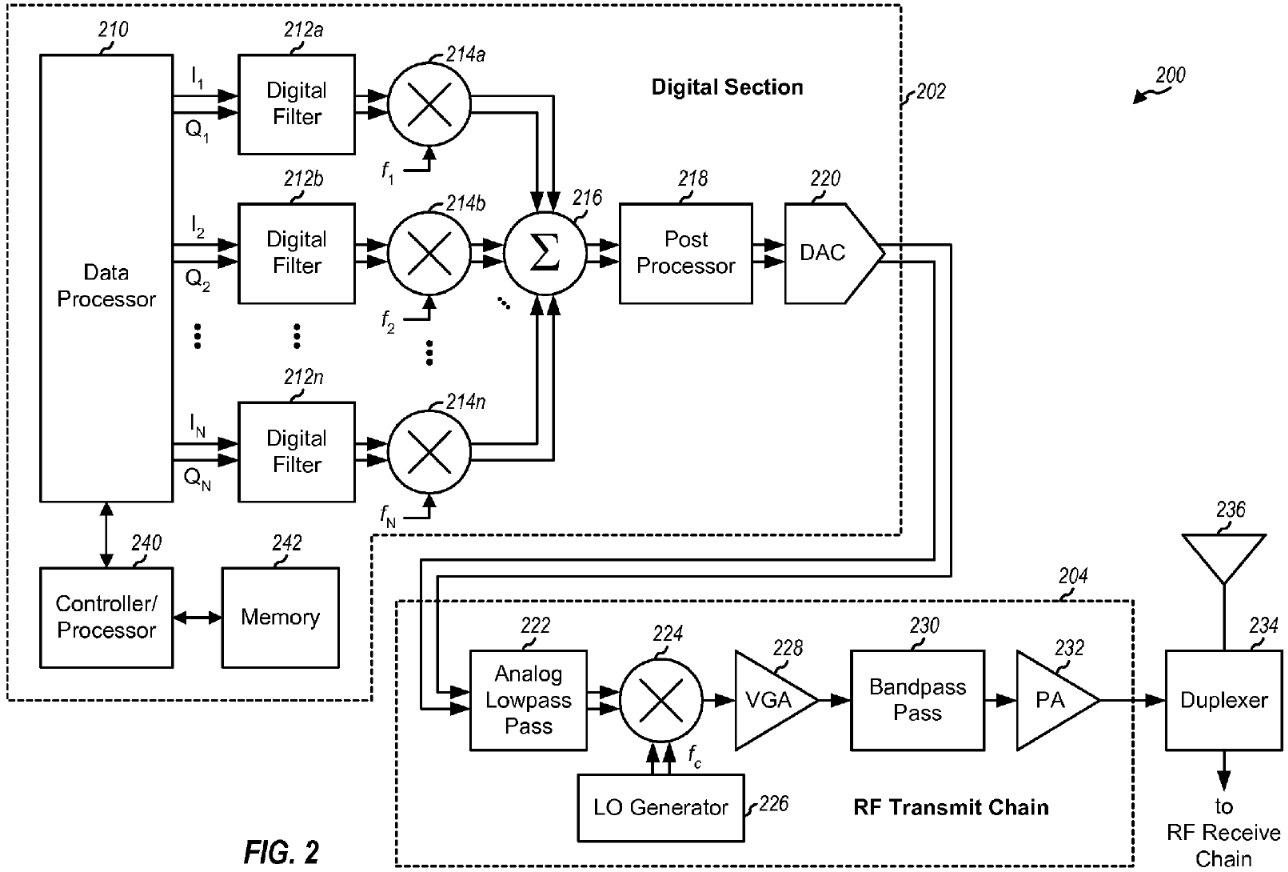
<table>
<tr><th>Claim 10 of the '802 Patent</th><th>Prior Art Reference – Rick</th></tr>
<tr><td></td><td>

FIG. 2

See, e.g., Rick at Figure 2.</td></tr>
</table>

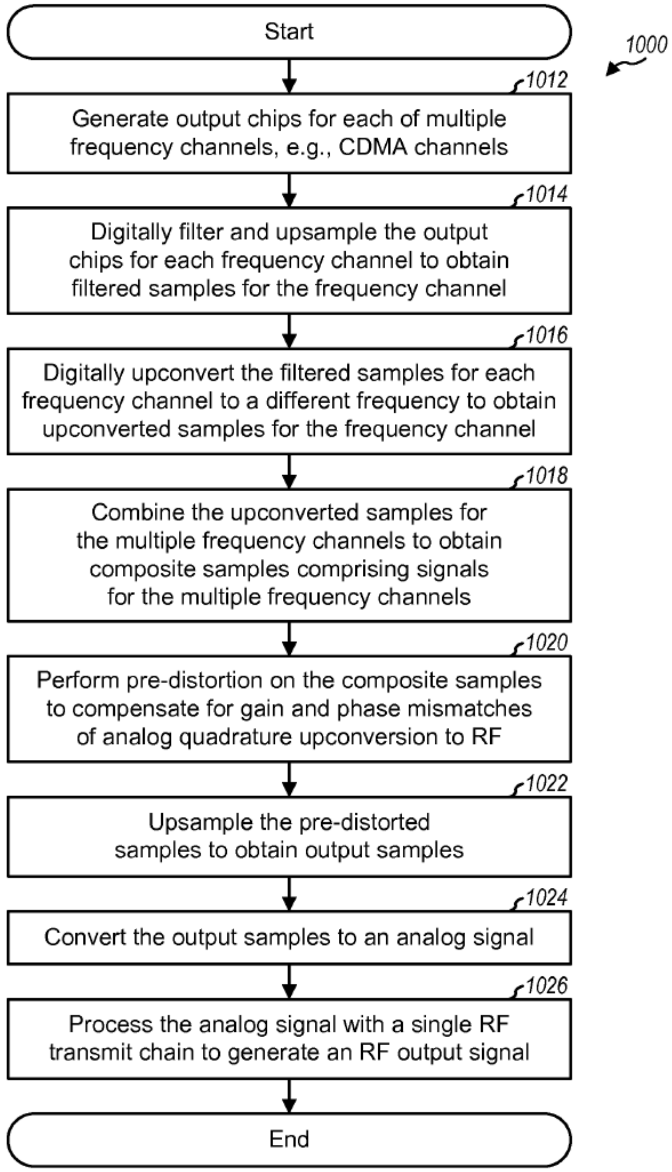

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.5] converting the second digital signal into a second analog signal using a second digital-to-analog converter, the second analog signal carrying the second data across a second frequency range;	Rick discloses "converting the second digital signal into a second analog signal using a second digital-to-analog converter, the second analog signal carrying the second data across a second frequency range." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

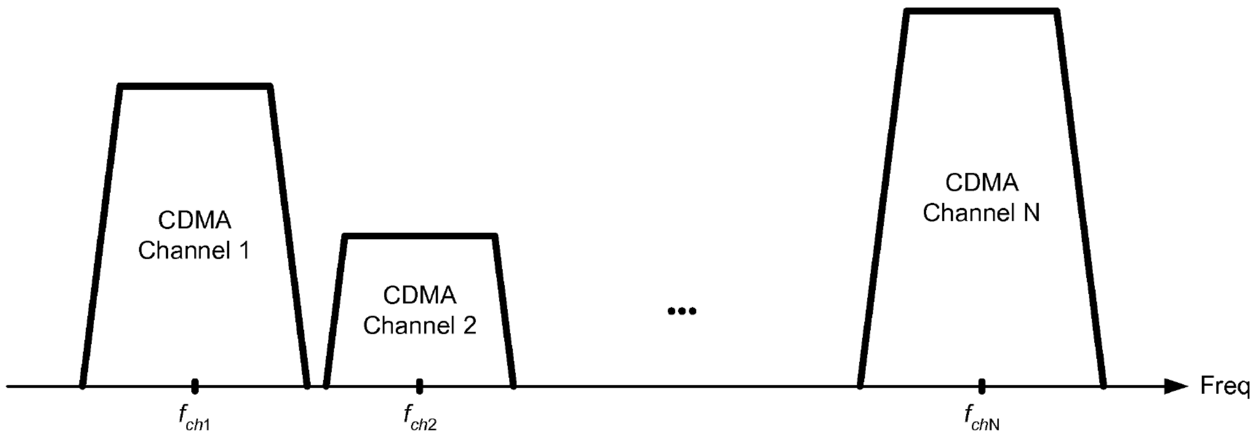
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

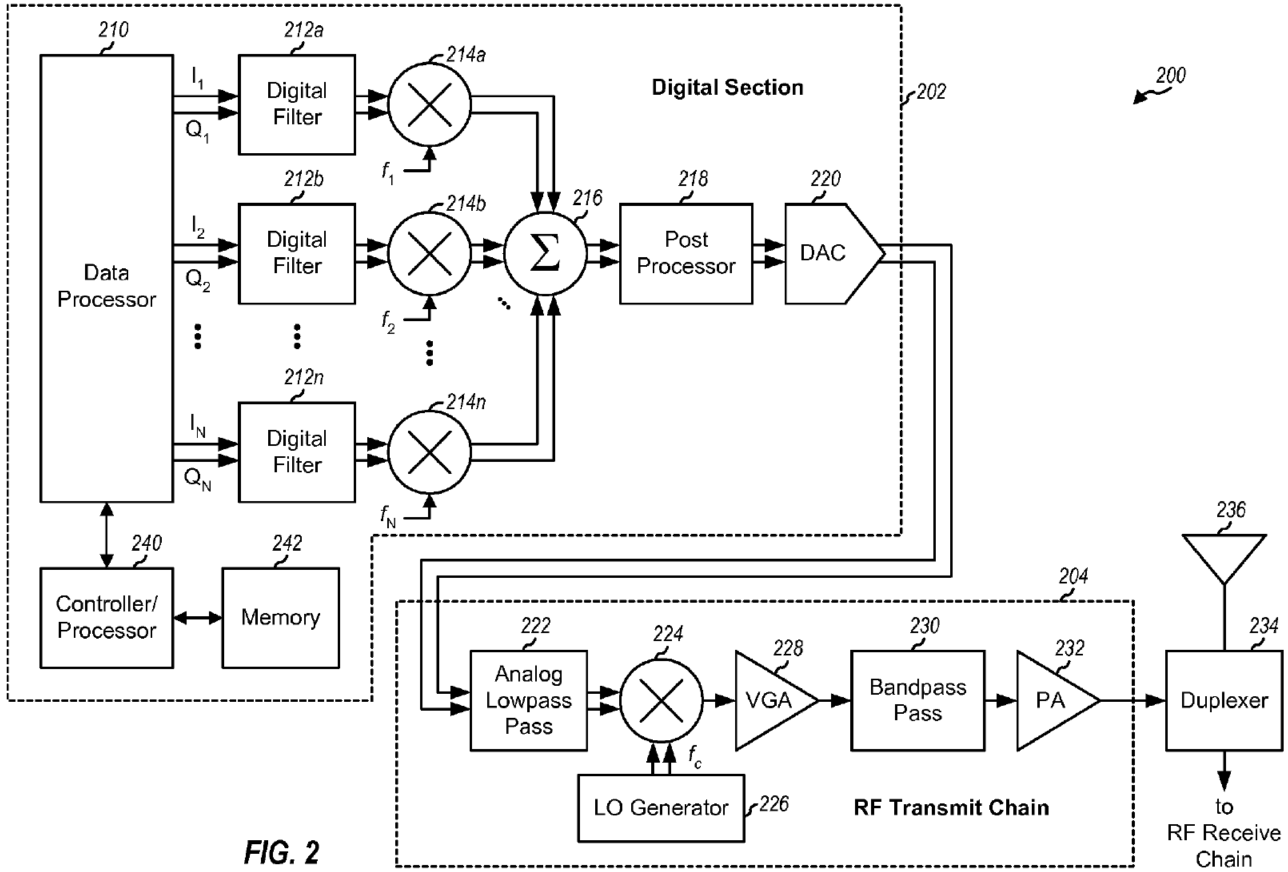
Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

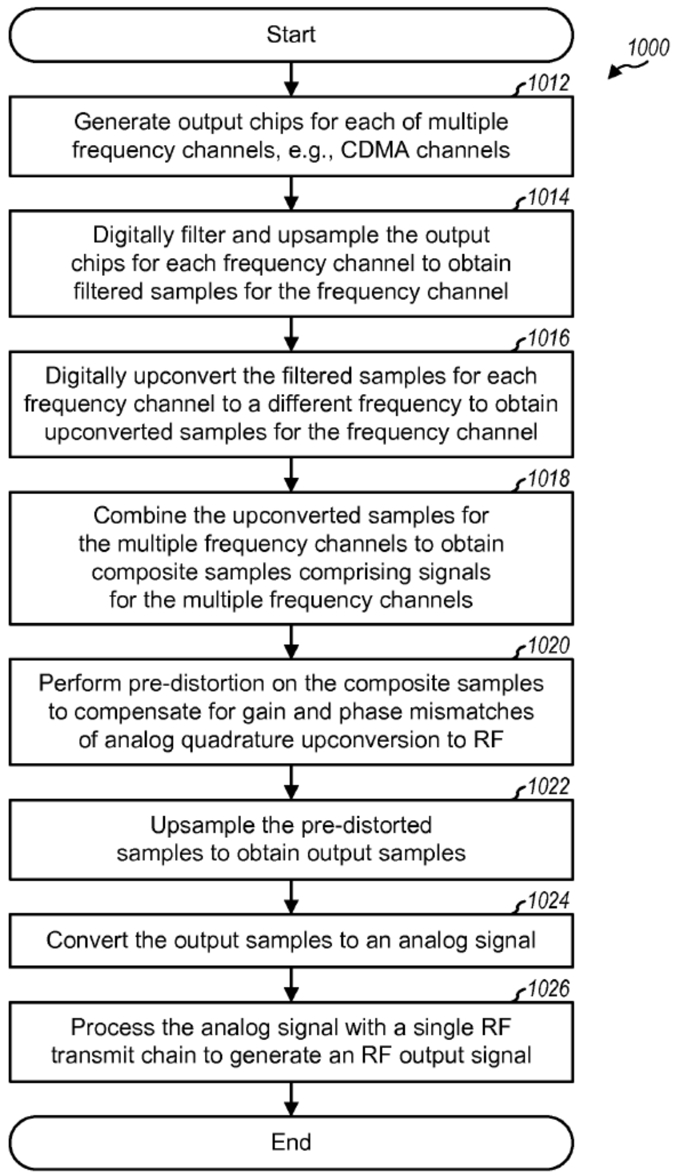

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.6] up-converting the first analog signal to a first RF center frequency to produce a first up-converted analog signal, wherein the first up-converted analog signal comprises a first up-converted frequency range from the first RF center frequency minus one-half the first frequency range to the first RF center frequency plus one-half the first frequency range;	Rick discloses "up-converting the first analog signal to a first RF center frequency to produce a first up-converted analog signal, wherein the first up-converted analog signal comprises a first up-converted frequency range from the first RF center frequency minus one-half the first frequency range to the first RF center frequency plus one-half the first frequency range." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access

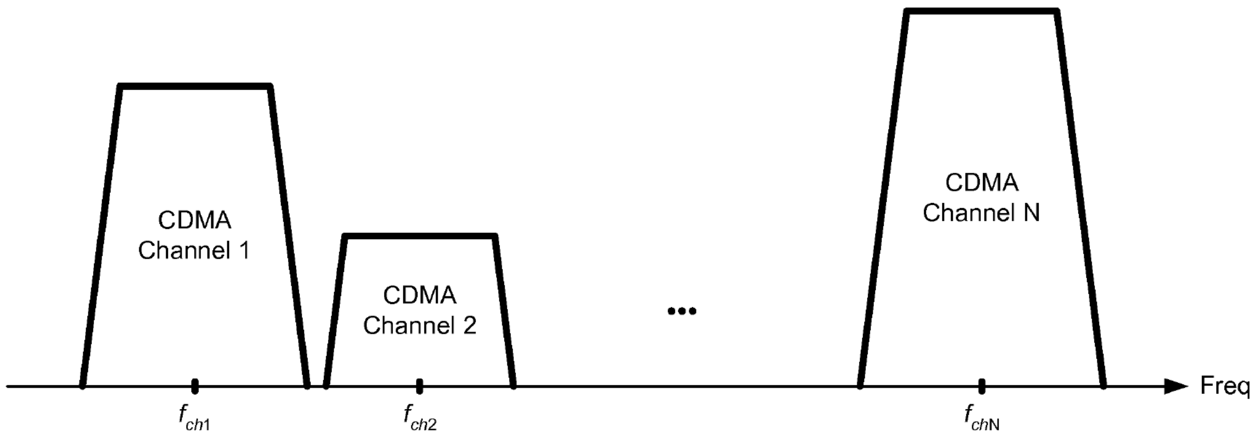
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output

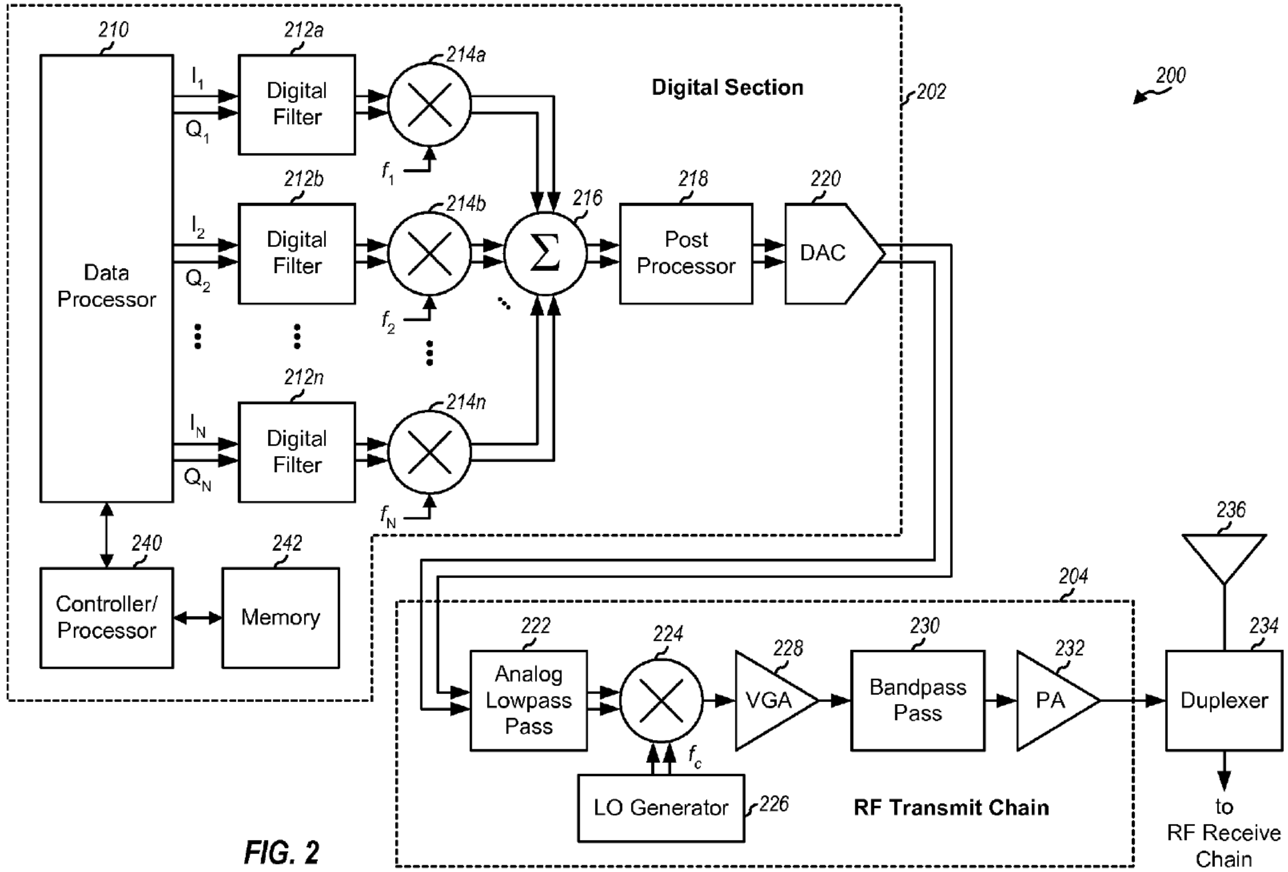
Claim 10 of the '802 Patent	**Prior Art Reference – Rick**
	samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N≧1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system.

Claim 10 of the '802 Patent	**Prior Art Reference – Rick**
	Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

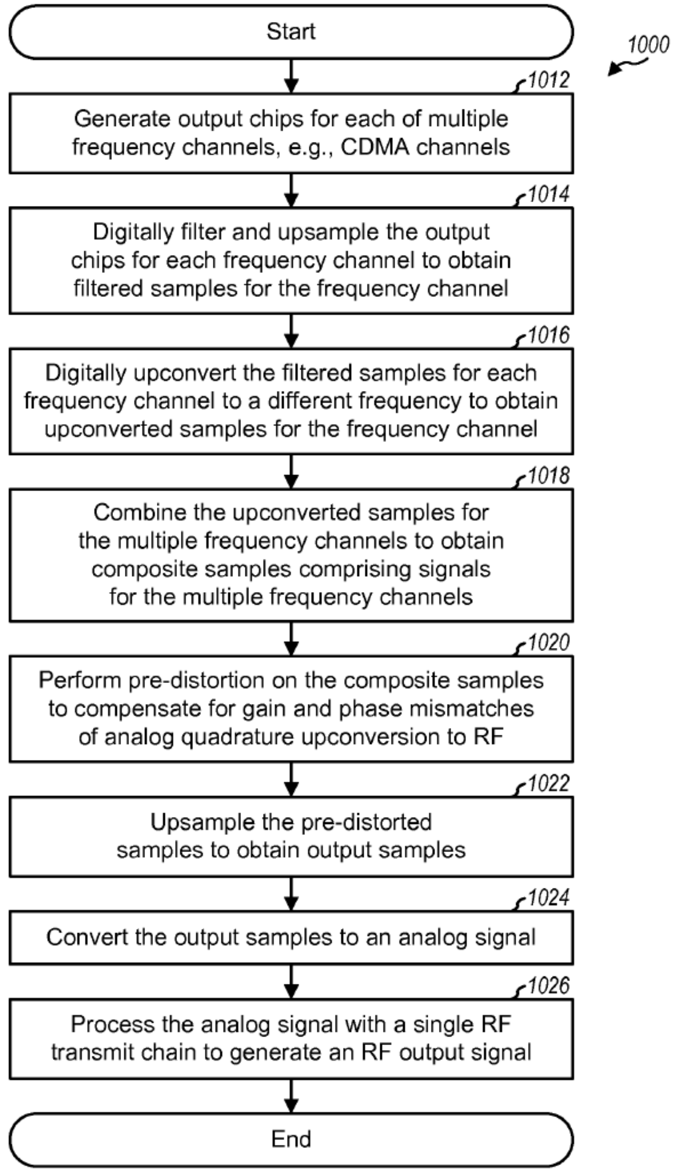

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.7] up-converting the second analog signal to a second RF center frequency greater than the first center RF frequency to produce a second up-converted analog signal, wherein the second up-converted analog signal comprises a second up-converted frequency range from the second RF center frequency minus one-half the second frequency range to the second RF center frequency plus one-half the second frequency range, and wherein a frequency difference between the first RF center frequency and the second RF center frequency is greater than the sum of one-half the	Rick discloses “up-converting the second analog signal to a second RF center frequency greater than the first center RF frequency to produce a second up-converted analog signal, wherein the second up-converted analog signal comprises a second up-converted frequency range from the second RF center frequency minus one-half the second frequency range to the second RF center frequency plus one-half the second frequency range, and wherein a frequency difference between the first RF center frequency and the second RF center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

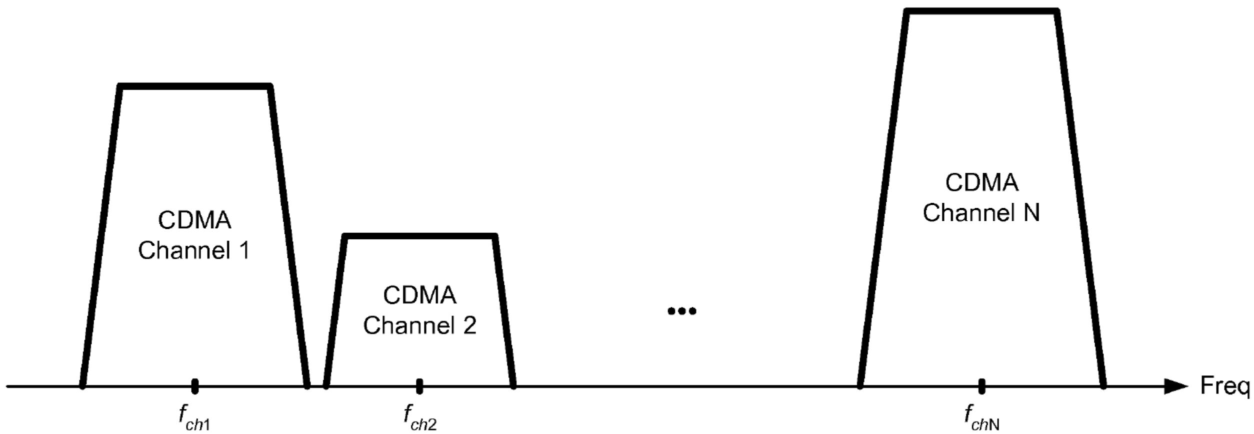
Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
first frequency range and one-half the second frequency range;	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

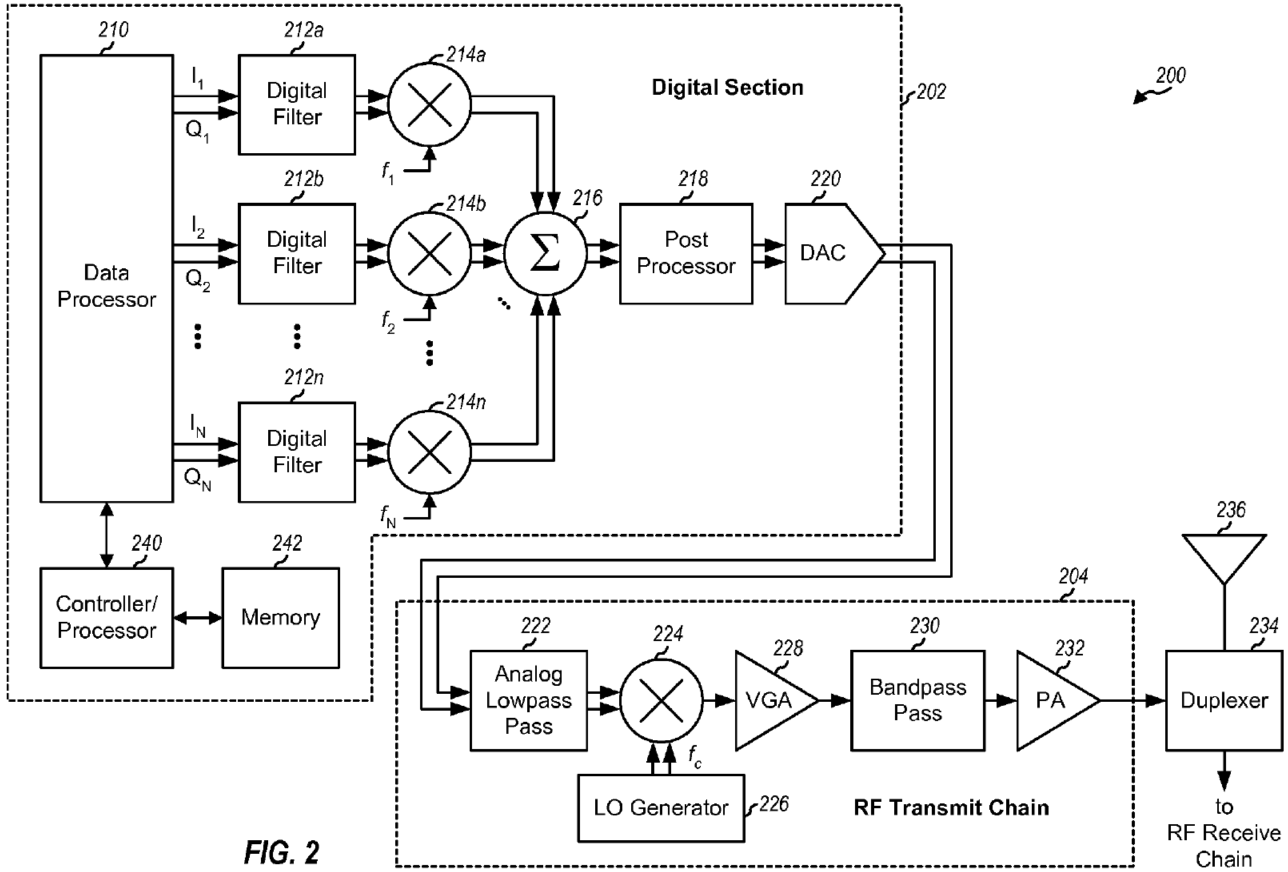
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47.

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See*, *e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See*, *e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

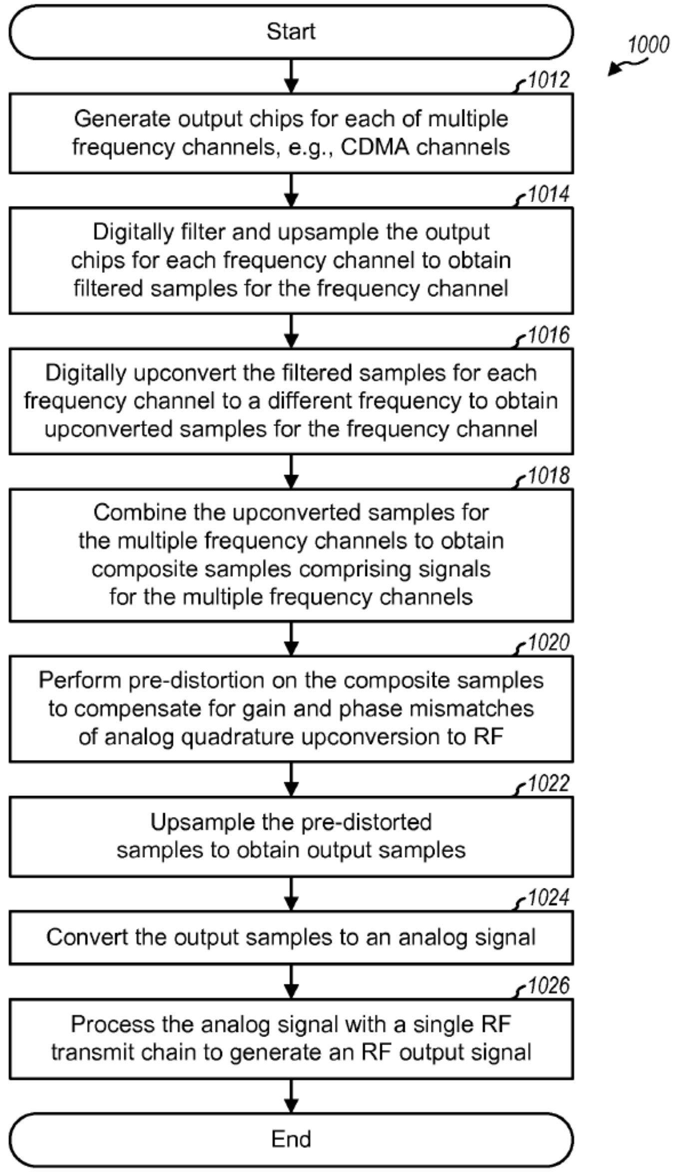

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.8] combining the first up-converted analog signal and the second up-converted analog signal to produce a combined up-converted signal;	Rick discloses "combining the first up-converted analog signal and the second up-converted analog signal to produce a combined up-converted signal." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time

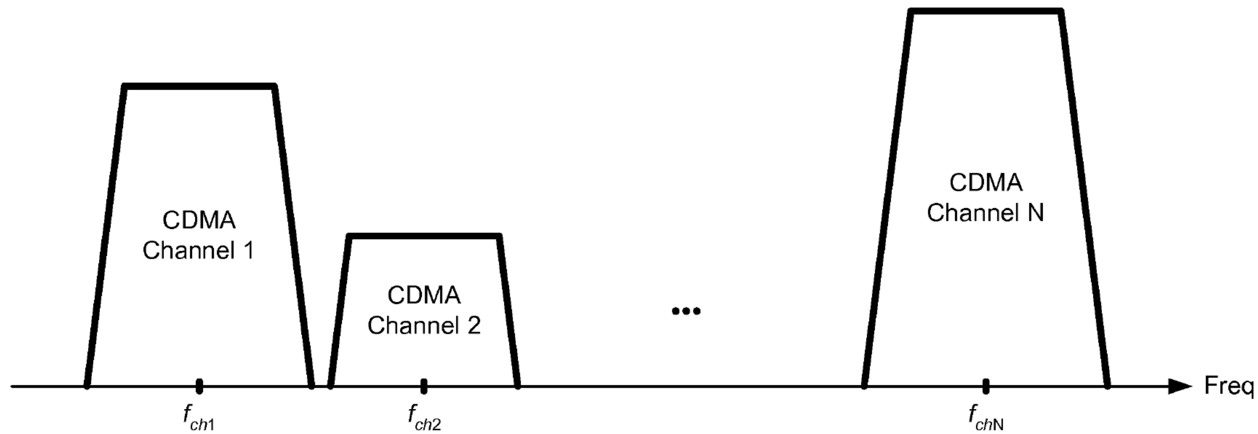
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

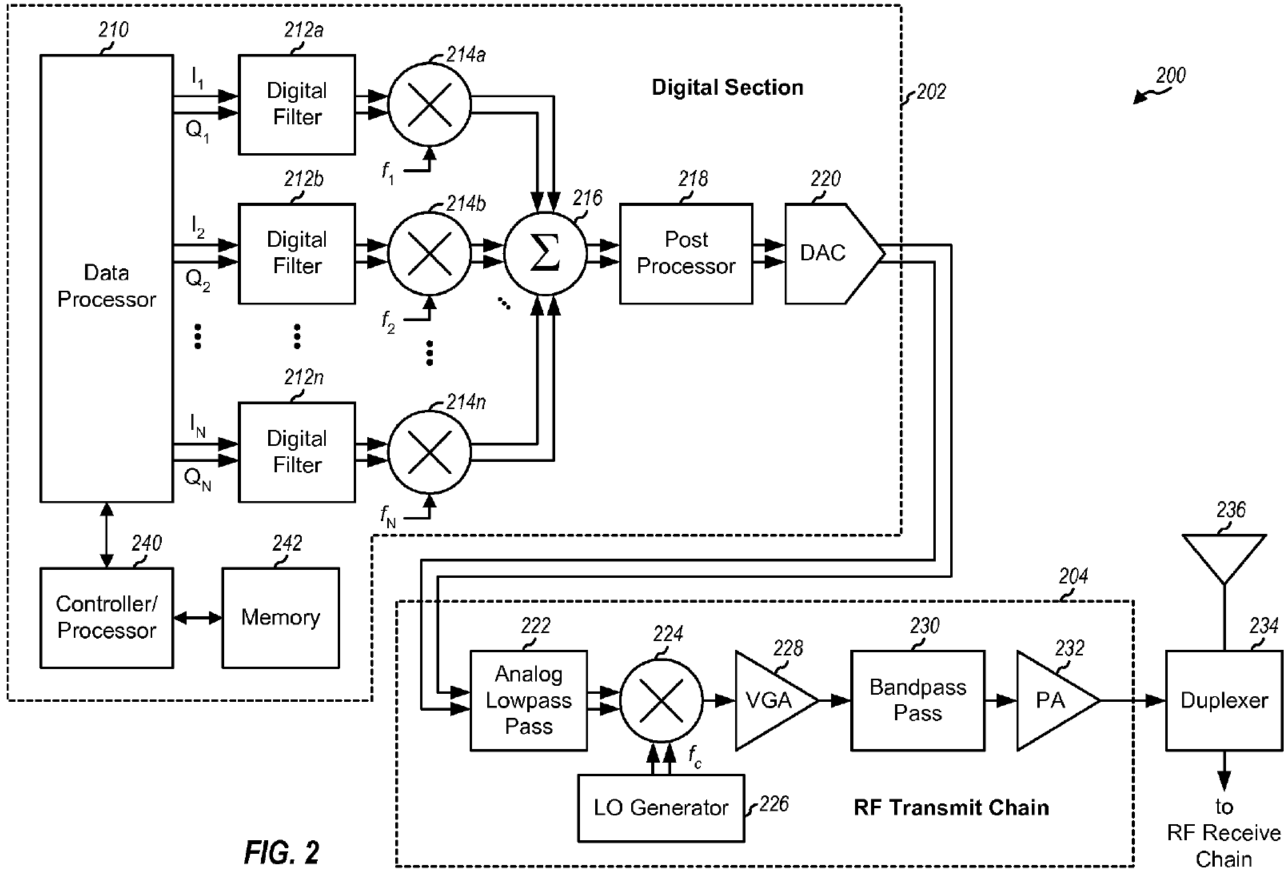
Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	 *FIG. 1* *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

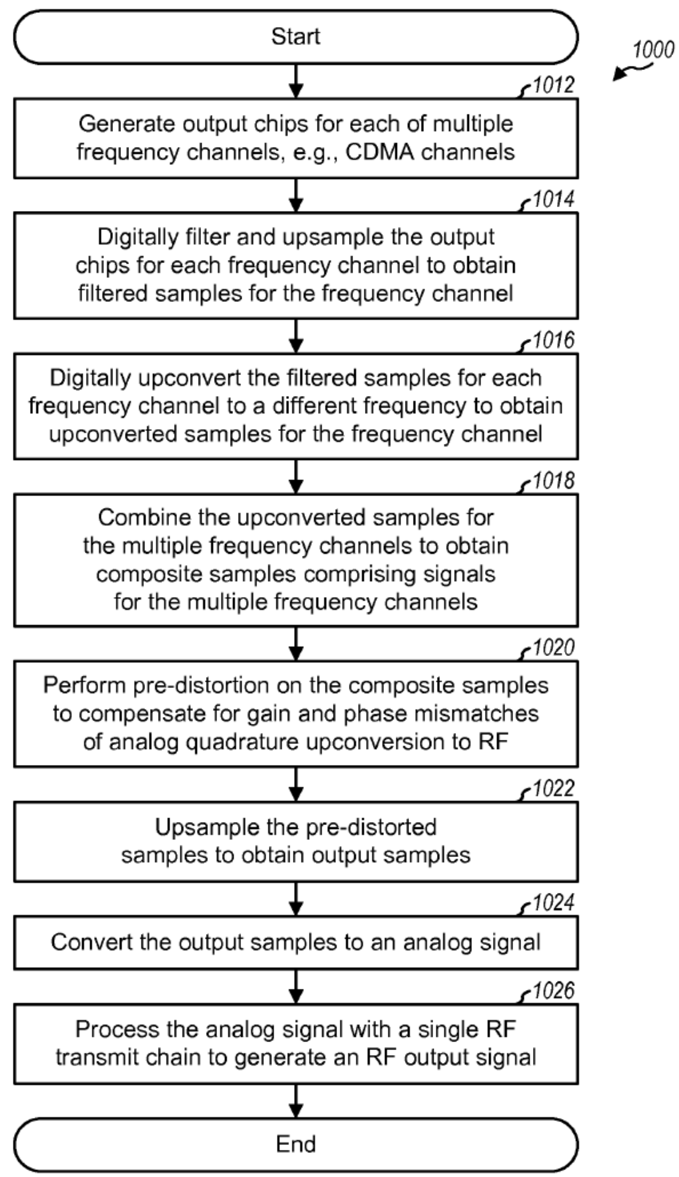

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.9] amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal; and	Rick discloses “amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time

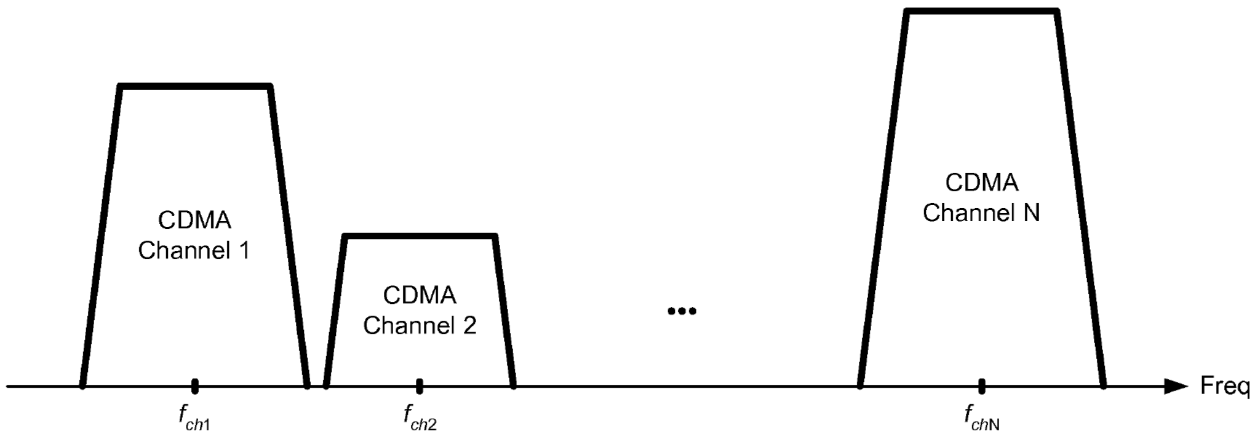
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

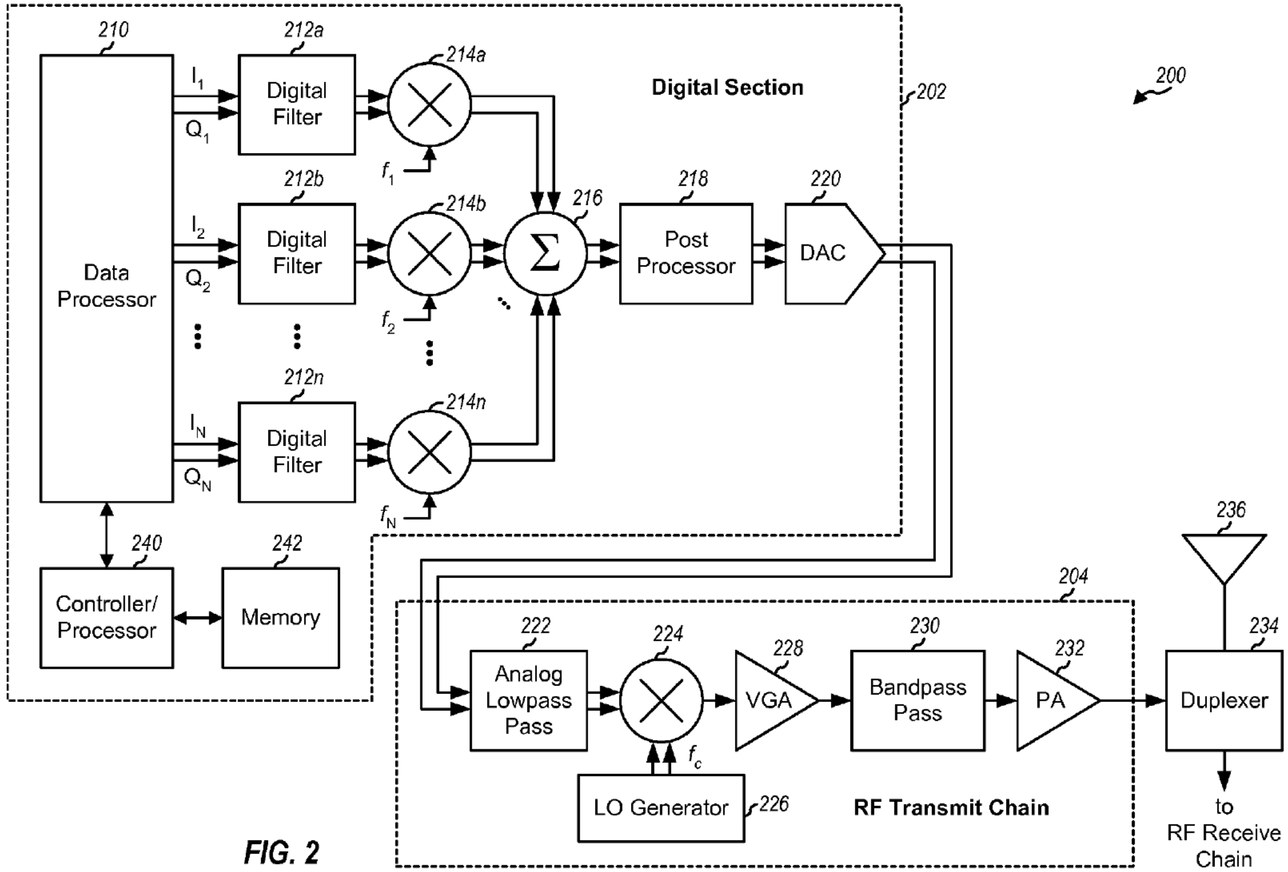
Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

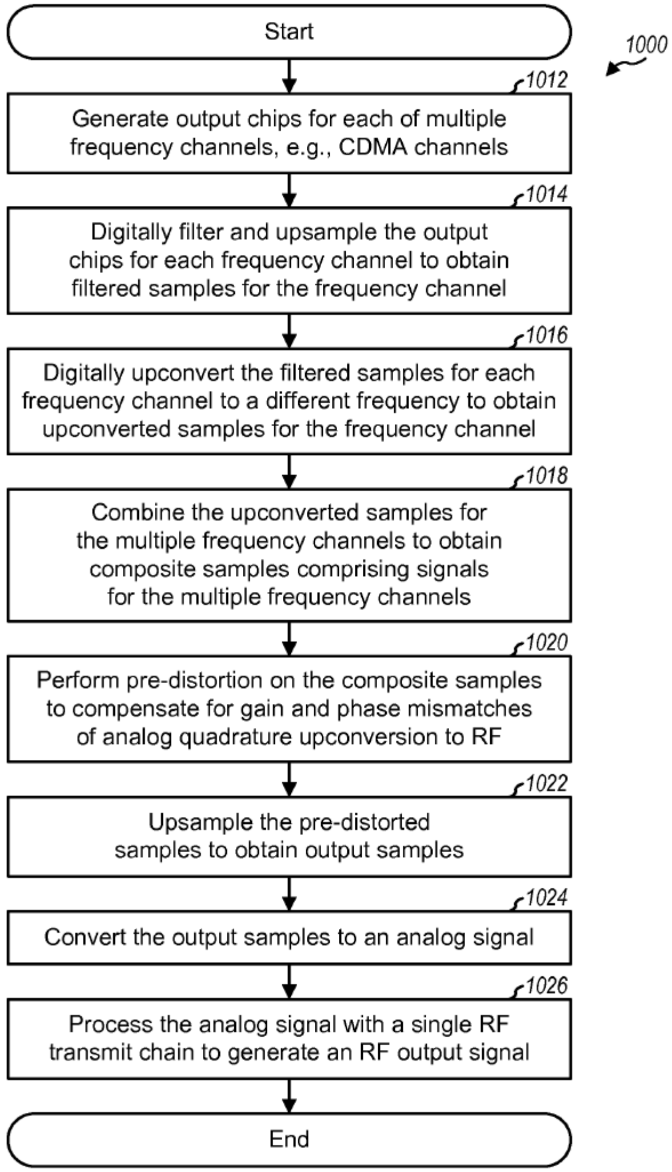
Claim 10 of the '802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N≧1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.



Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the '802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.10] transmitting the amplified combined up-converted signal on a first antenna,	Rick discloses "transmitting the amplified combined up-converted signal on a first antenna." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time

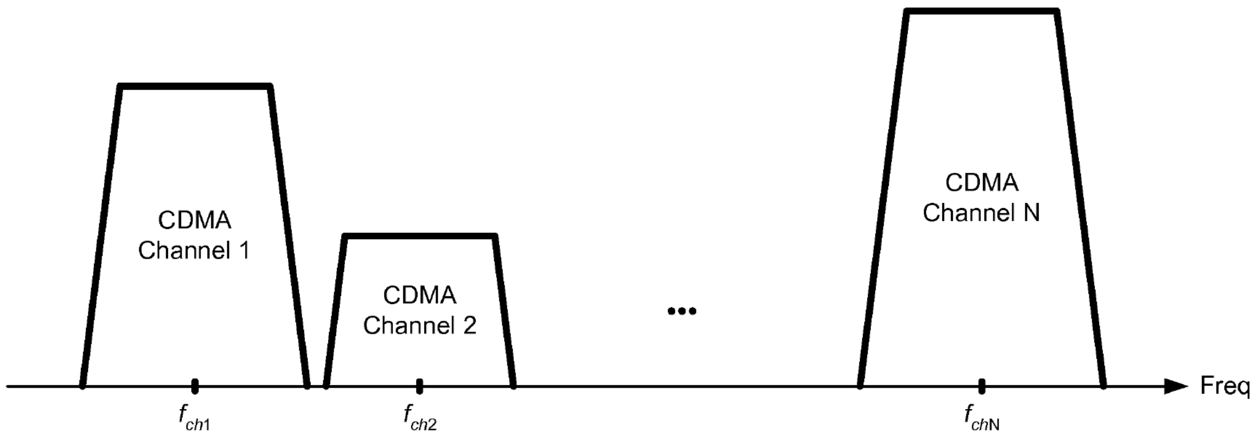
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

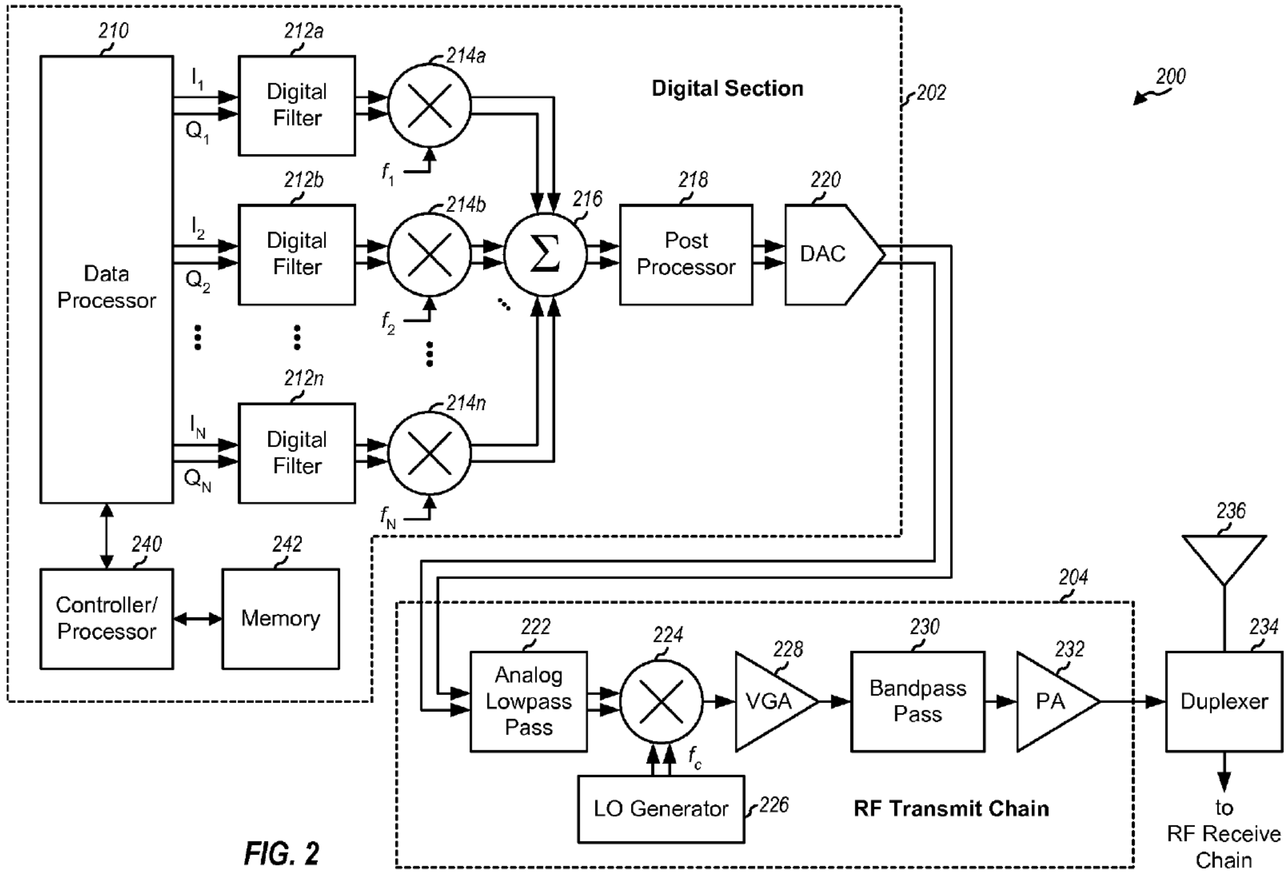
Claim 10 of the '802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

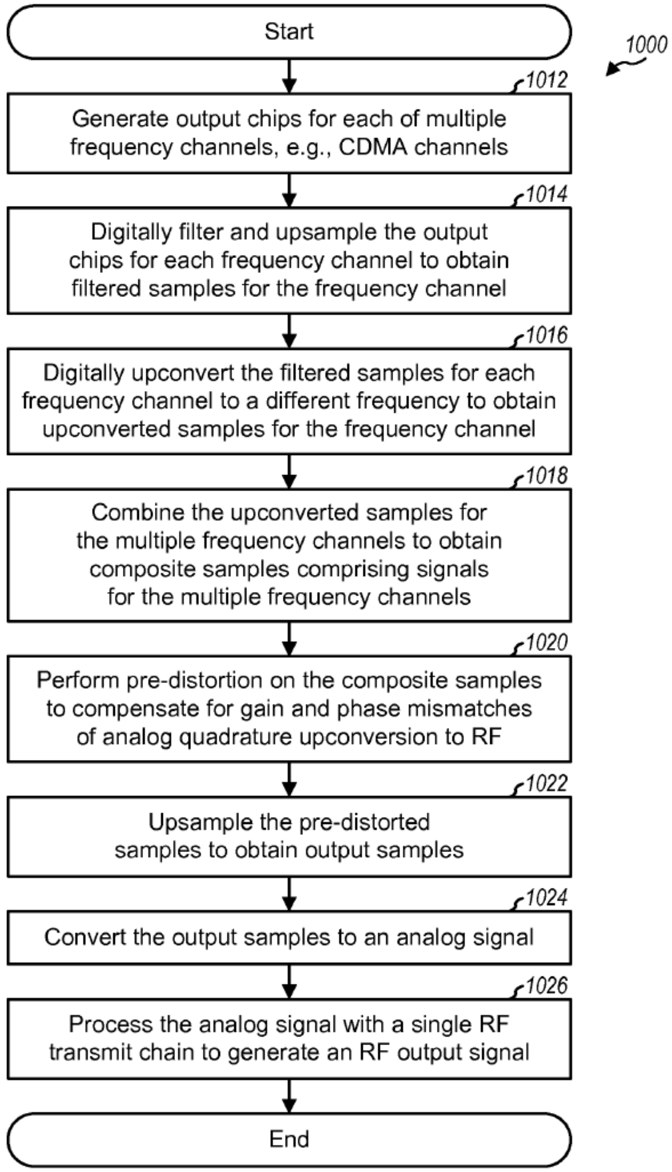

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[10.11] wherein the bandwidth of said power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.	Rick discloses “wherein the bandwidth of said power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

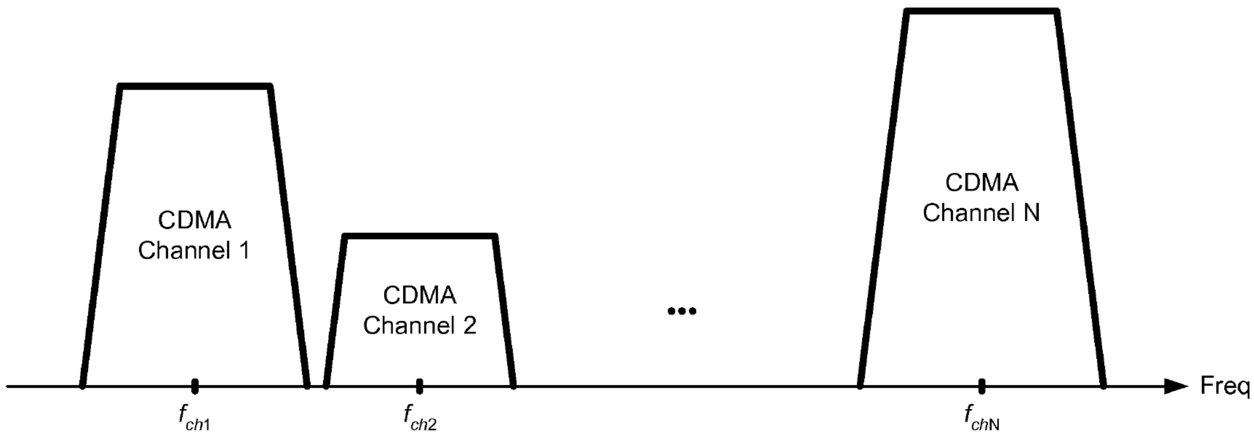
Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

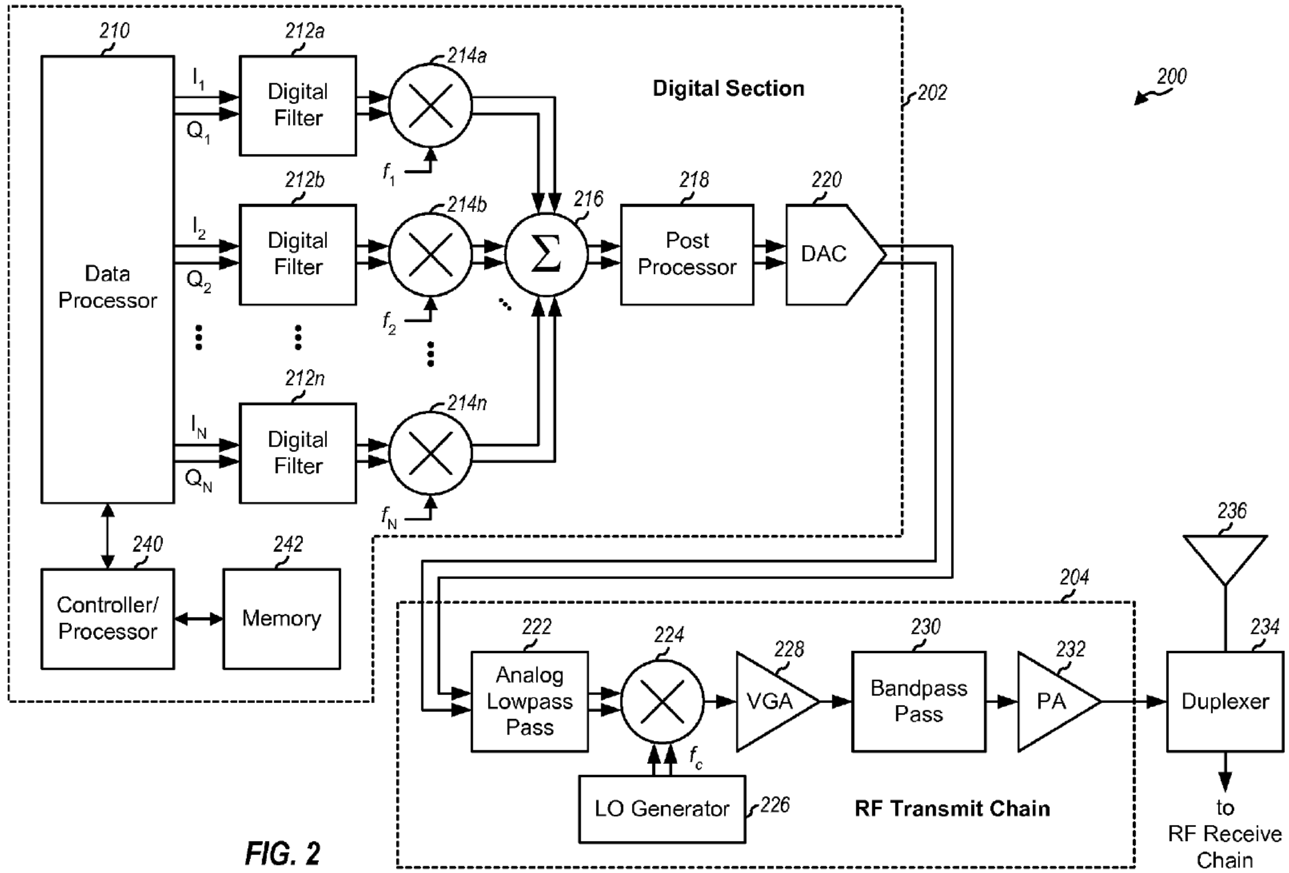
Claim 10 of the ’802 Patent	**Prior Art Reference – Rick**
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 10 of the '802 Patent	**Prior Art Reference – Rick**
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 10 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

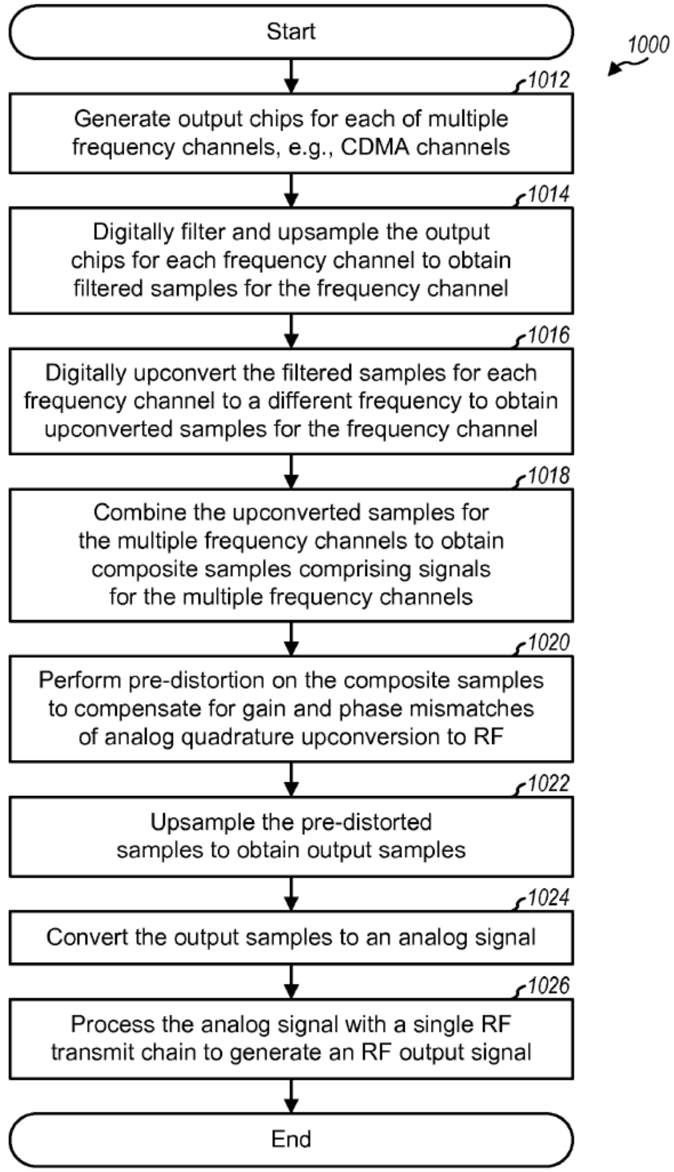

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 10 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 13 of the ’802 Patent	Prior Art Reference – Rick
[13.1] The method of claim 10	Rick discloses all the elements of claim 10 for all the reasons provided above.
[13.2] wherein the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol.	Rick discloses “wherein the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

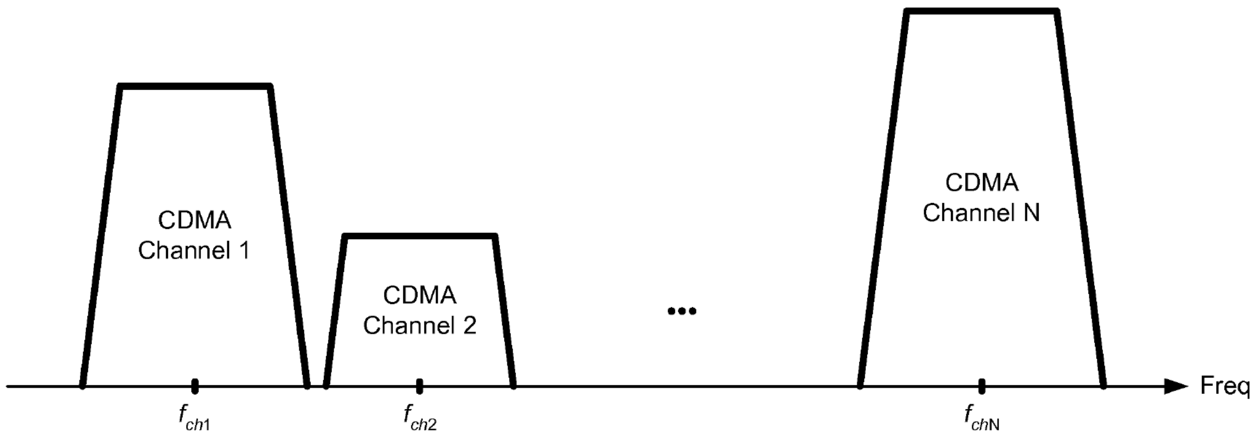
Claim 13 of the '802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

Claim 13 of the ’802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 13 of the ’802 Patent	**Prior Art Reference – Rick**
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N≧1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 13 of the ’802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 13 of the '802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 13 of the '802 Patent	Prior Art Reference – Rick
	 **FIG. 1** *See, e.g.*, Rick at Figure 1.

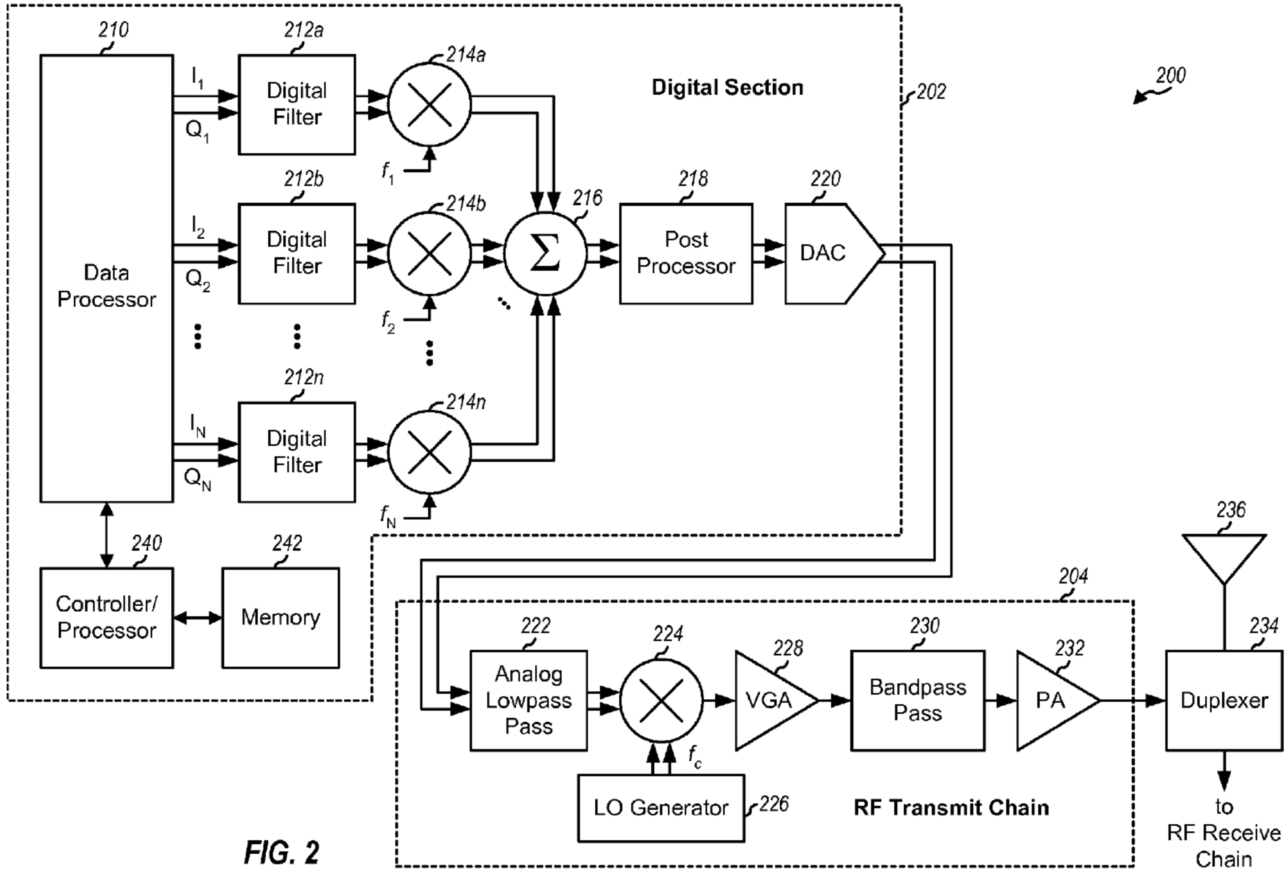
<table>
<tr><th>Claim 13 of the ’802 Patent</th><th>Prior Art Reference – Rick</th></tr>
<tr><td></td><td>

FIG. 2

See, e.g., Rick at Figure 2.</td></tr>
</table>

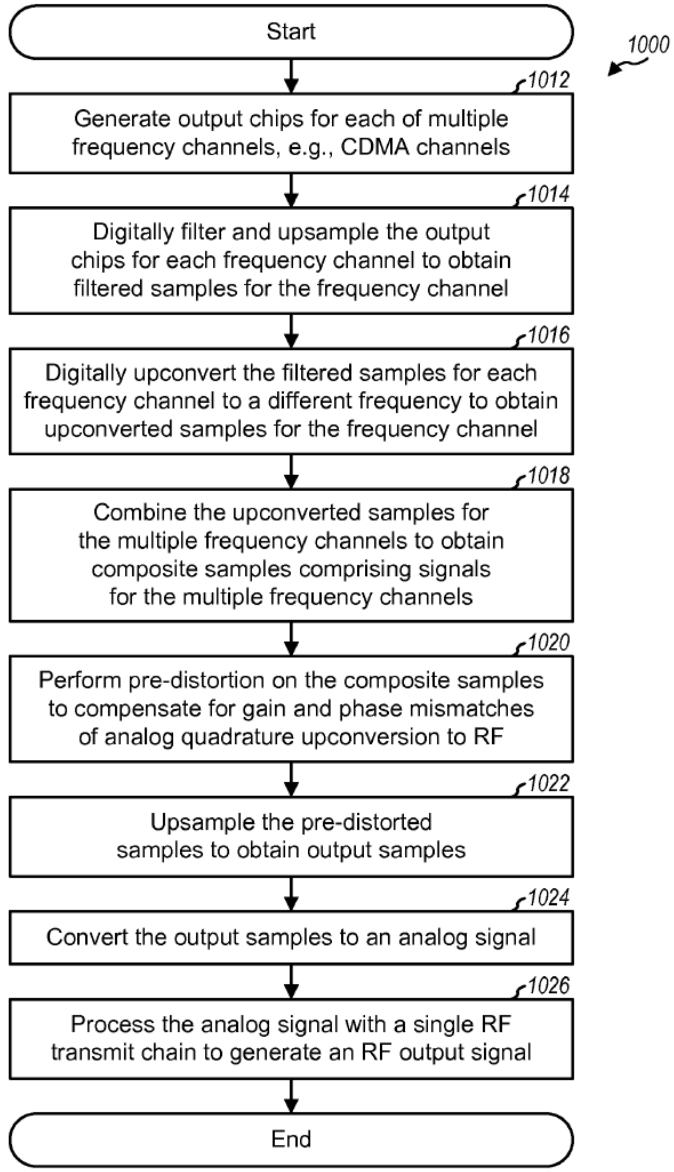

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 13 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
[14.1] The method of claim 10	Rick discloses all the elements of claim 10 for all the reasons provided above.
[14.2] wherein the second data is the same as the first data, the method further comprising:	Rick discloses “wherein the second data is the same as the first data, the method further comprising.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

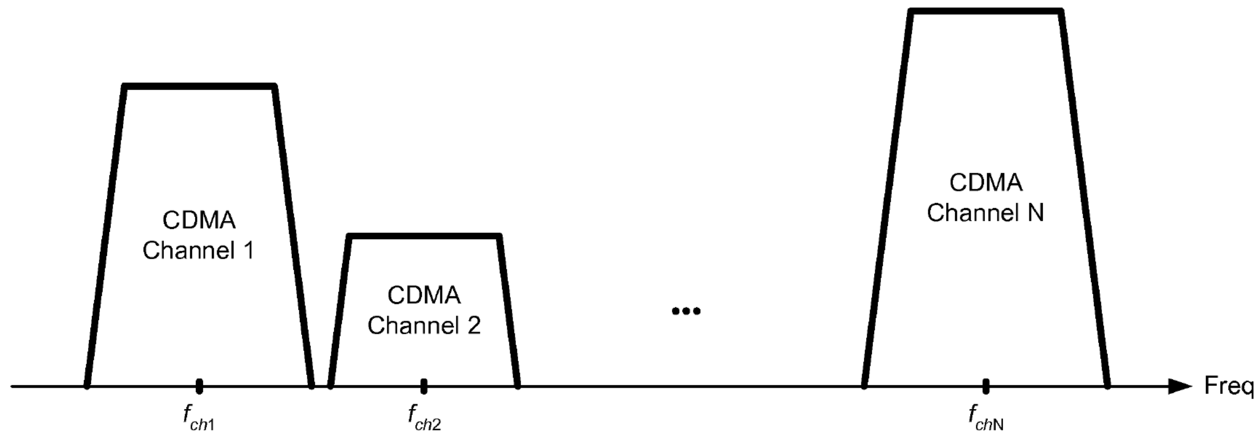
Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

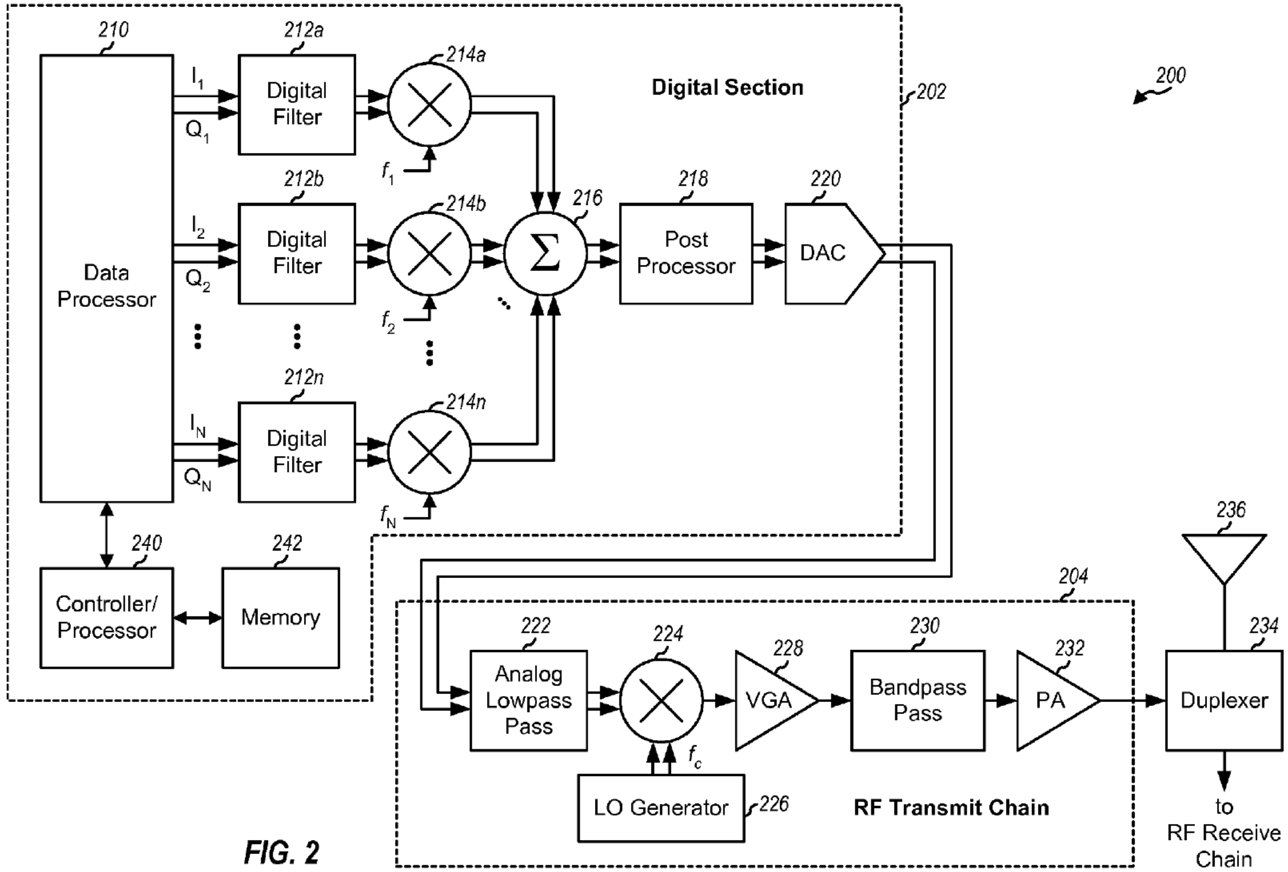
Claim 14 of the '802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

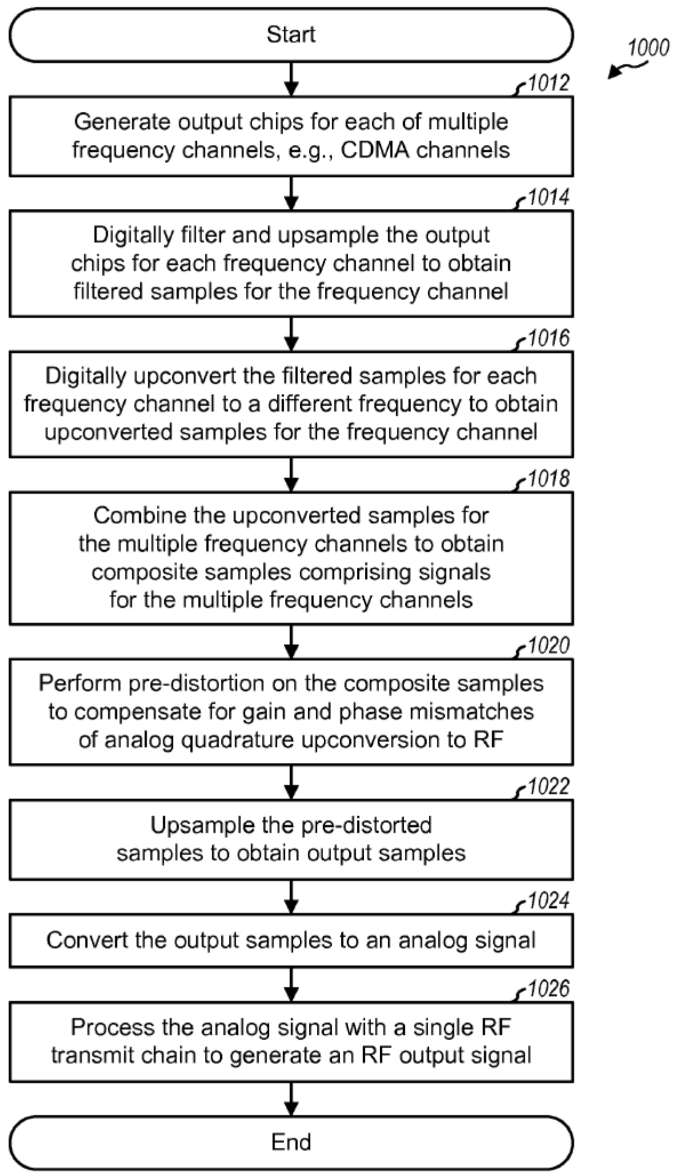

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[14.3] receiving the transmitted signal on a second antenna;	Rick discloses “receiving the transmitted signal on a second antenna.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time

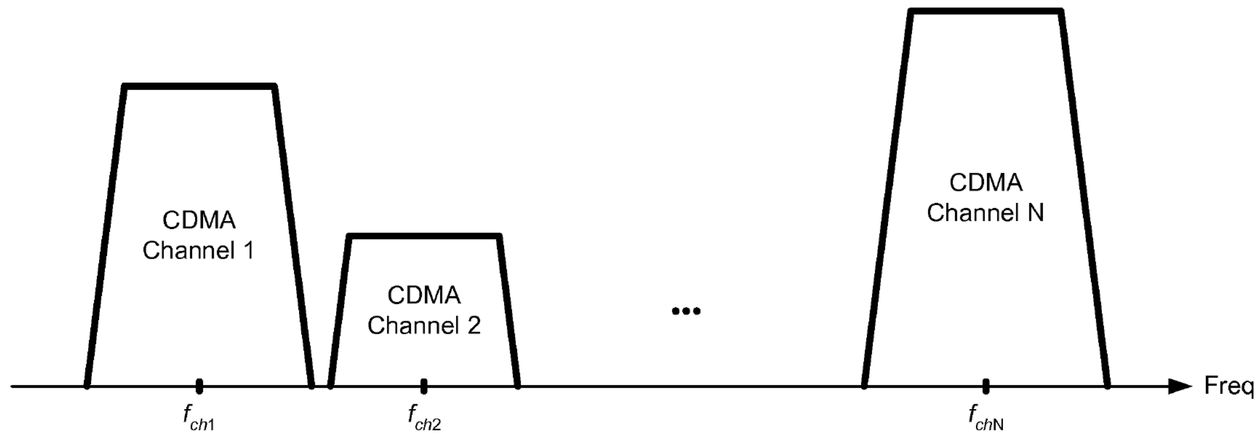
Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

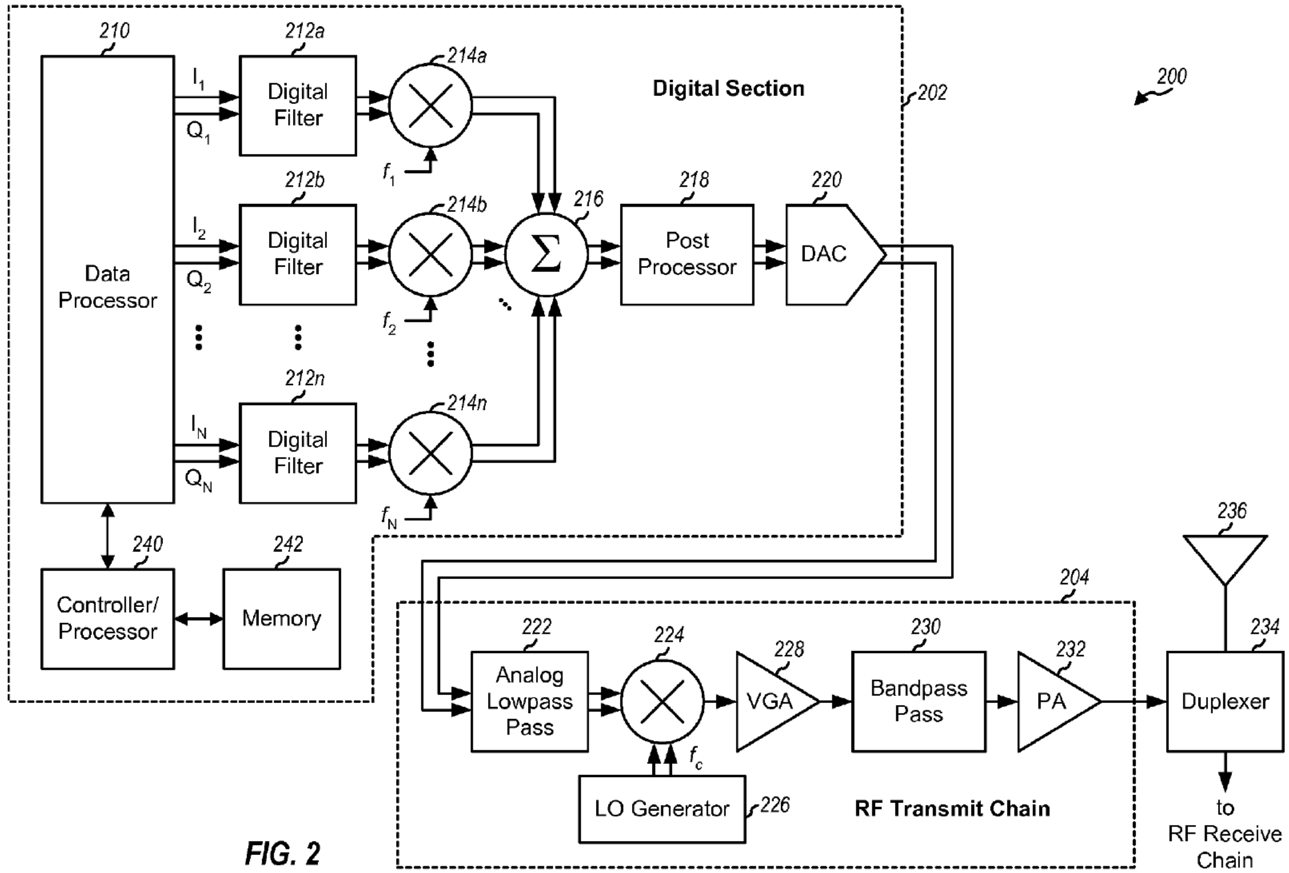
Claim 14 of the '802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

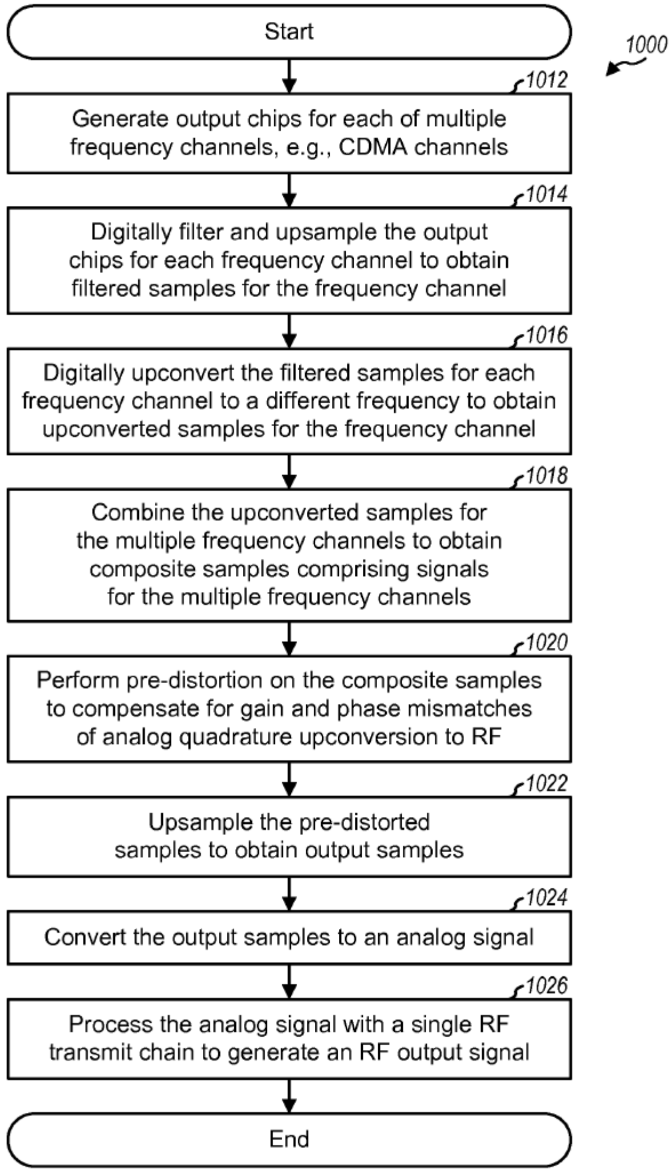

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[14.4] amplifying the received signal in a low noise amplifier resulting in an amplified received up-converted signal, wherein the bandwidth of said low noise amplifier is greater than the difference between the lowest frequency in the first up-converted frequency range and the highest frequency in the second up-converted frequency range;	Rick discloses "amplifying the received signal in a low noise amplifier resulting in an amplified received up-converted signal, wherein the bandwidth of said low noise amplifier is greater than the difference between the lowest frequency in the first up-converted frequency range and the highest frequency in the second up-converted frequency range." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access

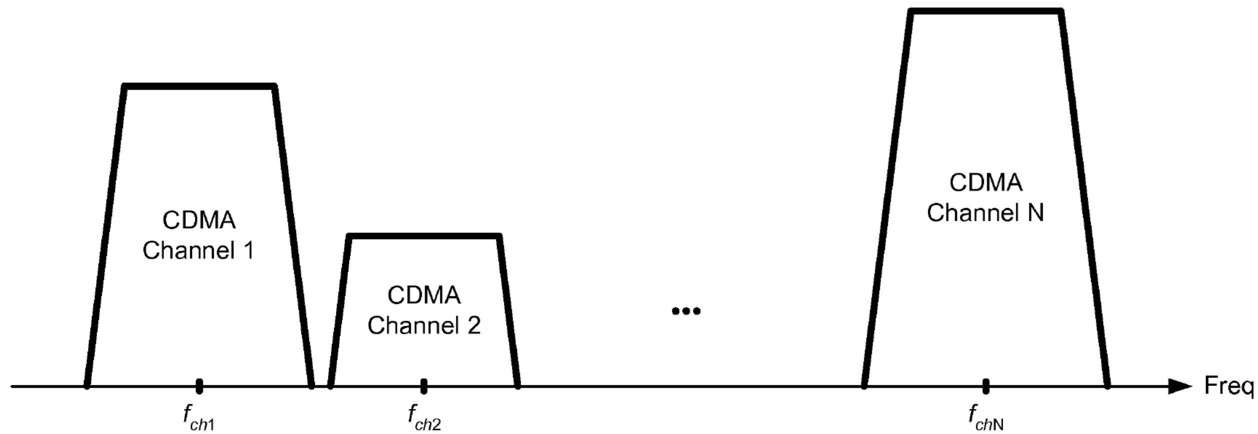
Claim 14 of the ’802 Patent	**Prior Art Reference – Rick**
	systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output

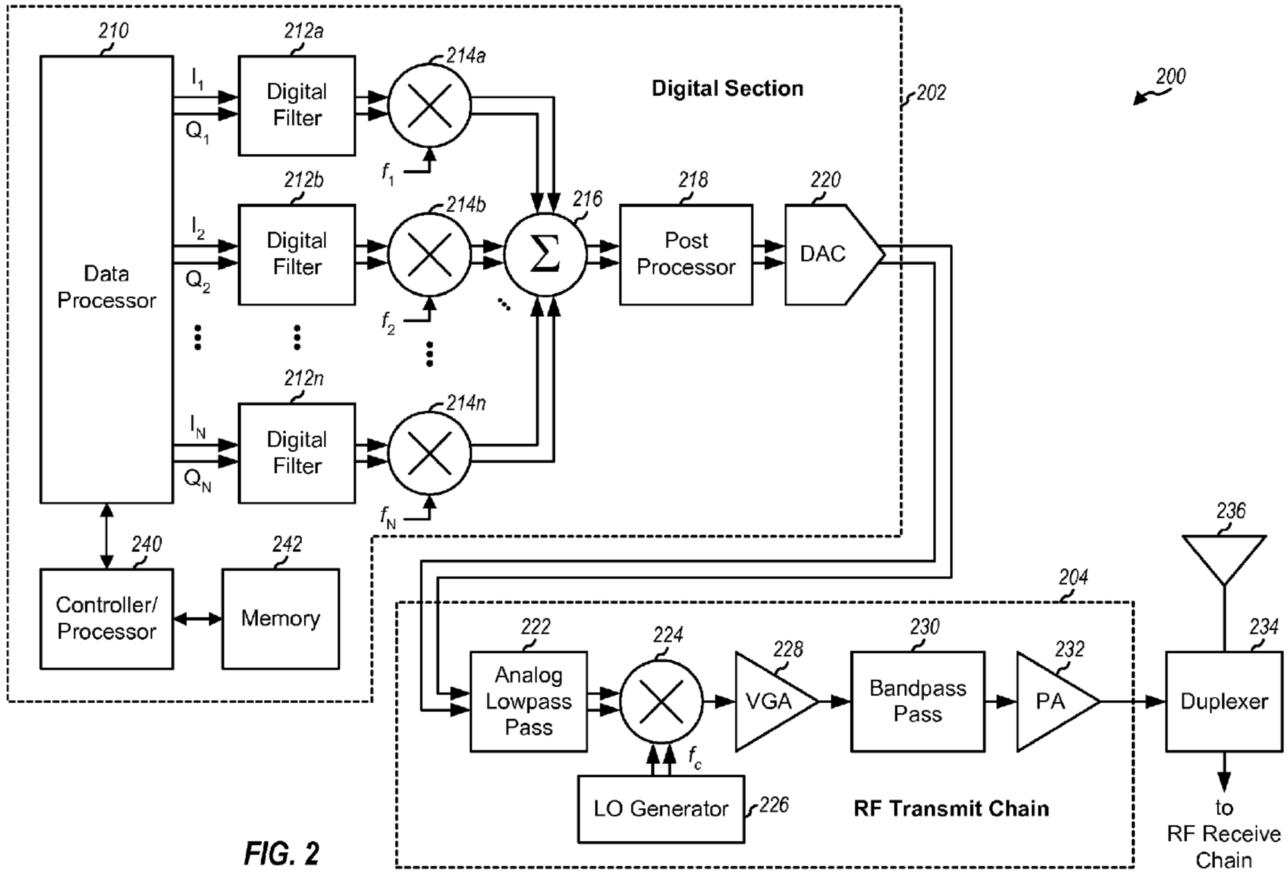
Claim 14 of the ’802 Patent	**Prior Art Reference – Rick**
	samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below.

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system.

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See*, *e.g.*, Rick at Figure 1.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

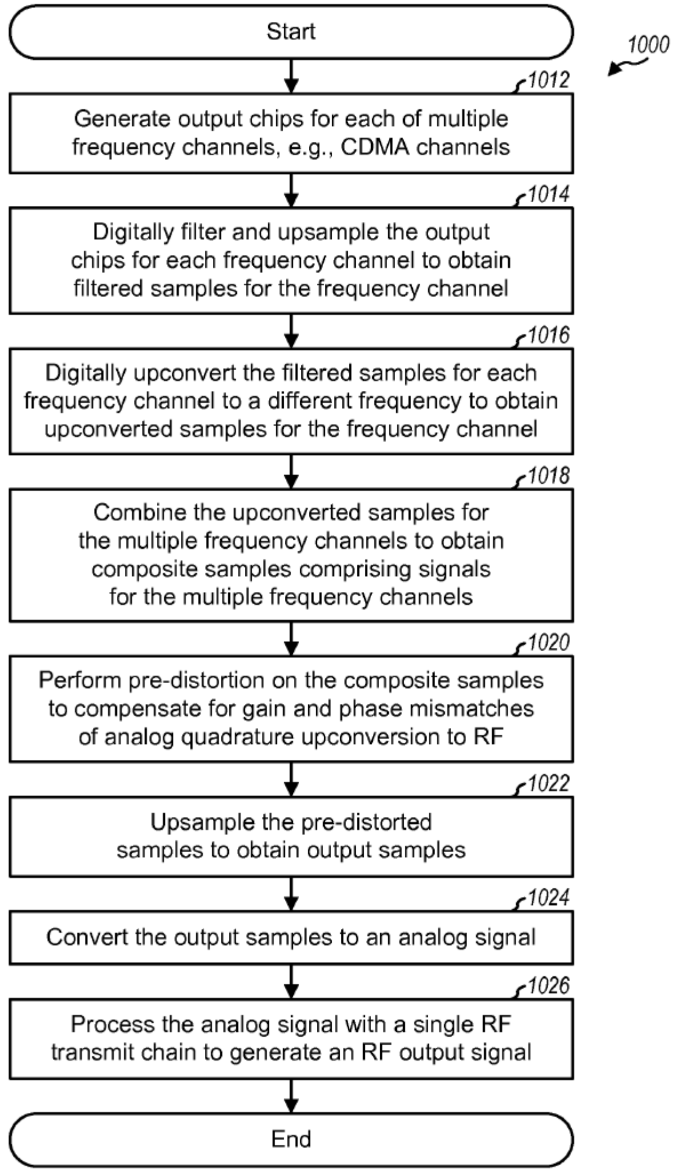

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[14.5] down-converting the amplified received up-converted signal using a first down-converter and a signal corresponding to the first RF center frequency to produce a fourth analog signal corresponding to the first analog signal; and	Rick discloses "down-converting the amplified received up-converted signal using a first down-converter and a signal corresponding to the first RF center frequency to produce a fourth analog signal corresponding to the first analog signal." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

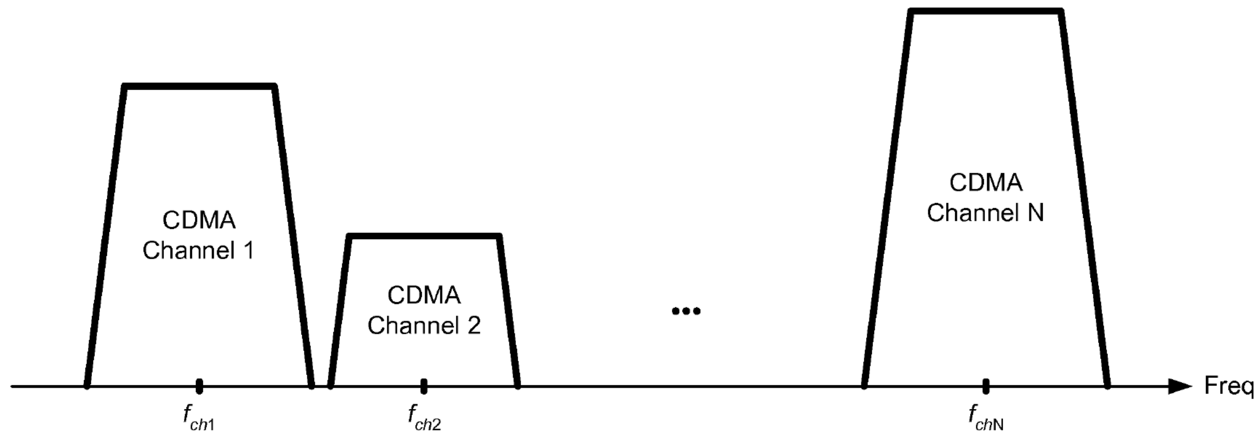
Claim 14 of the '802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

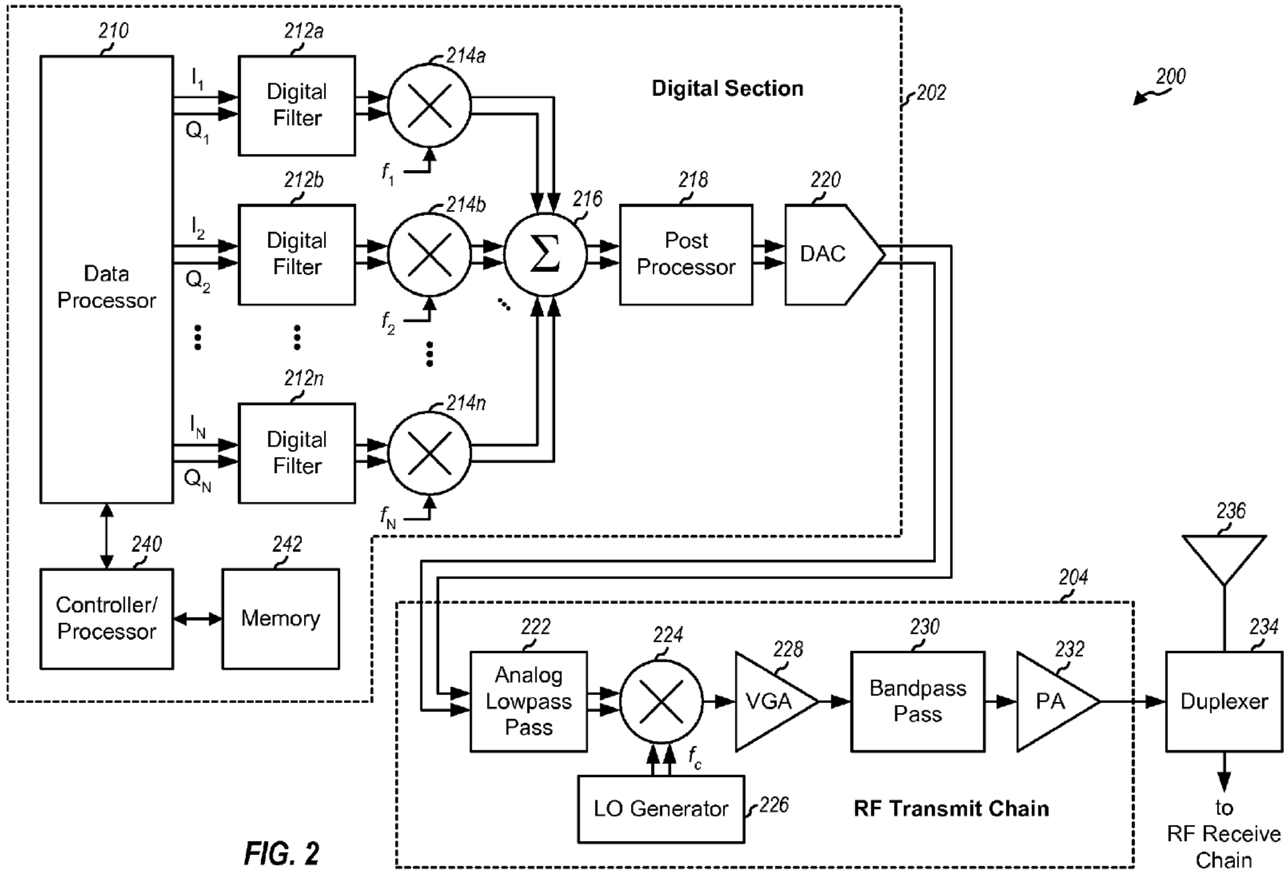
Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 14 of the ’802 Patent	**Prior Art Reference – Rick**
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

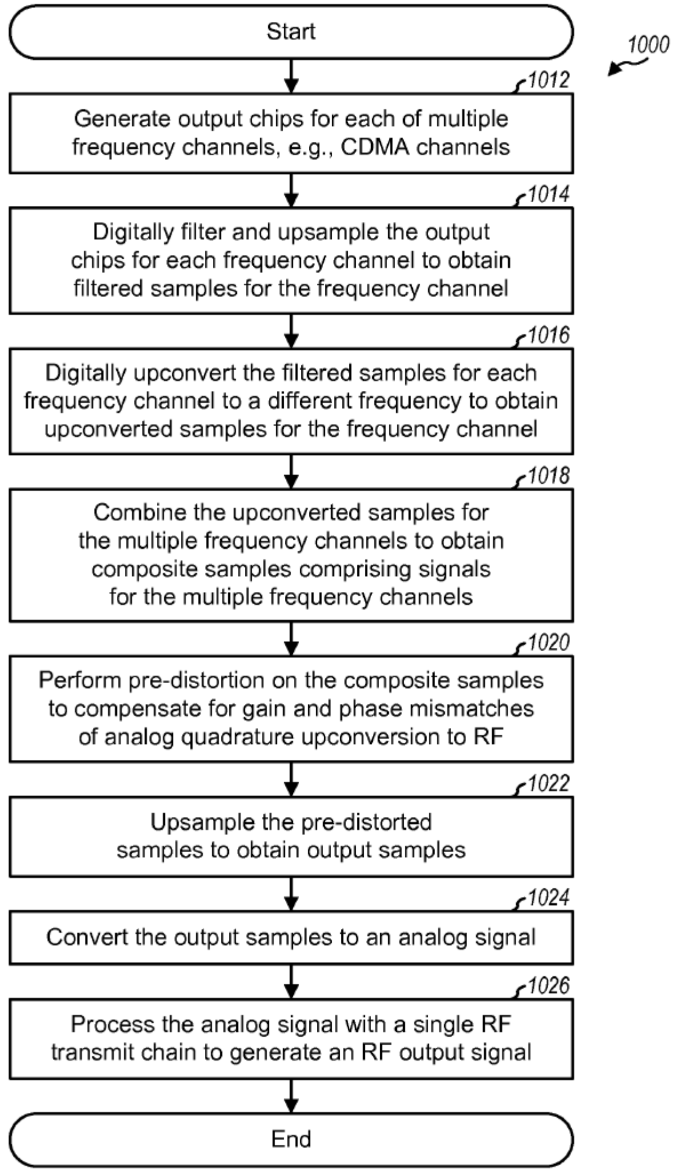

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[14.6] down-converting the amplified received up-converted analog signal using a second down-converter and a signal corresponding to the second RF center frequency to produce a fifth analog signal corresponding to the second analog signal.	Rick discloses “down-converting the amplified received up-converted analog signal using a second down-converter and a signal corresponding to the second RF center frequency to produce a fifth analog signal corresponding to the second analog signal.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

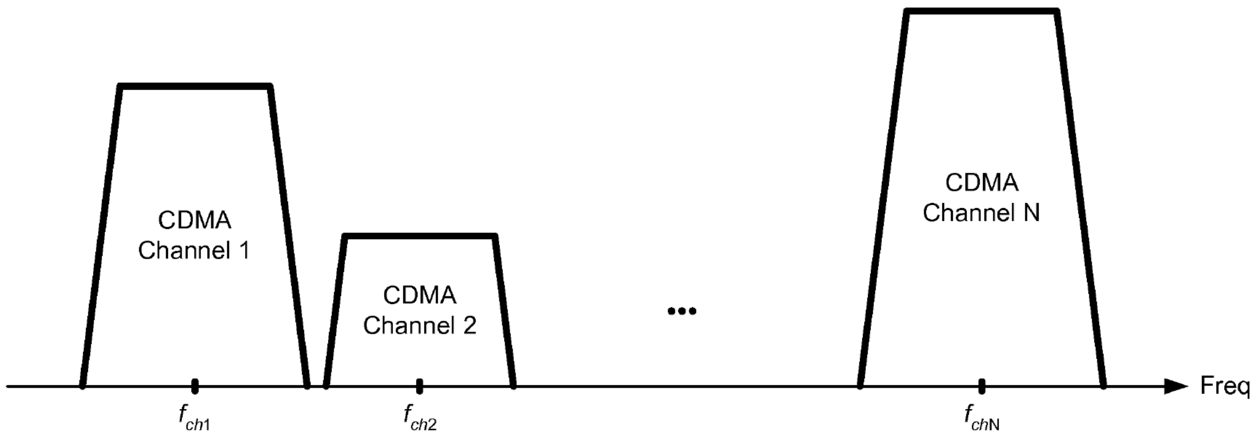
Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

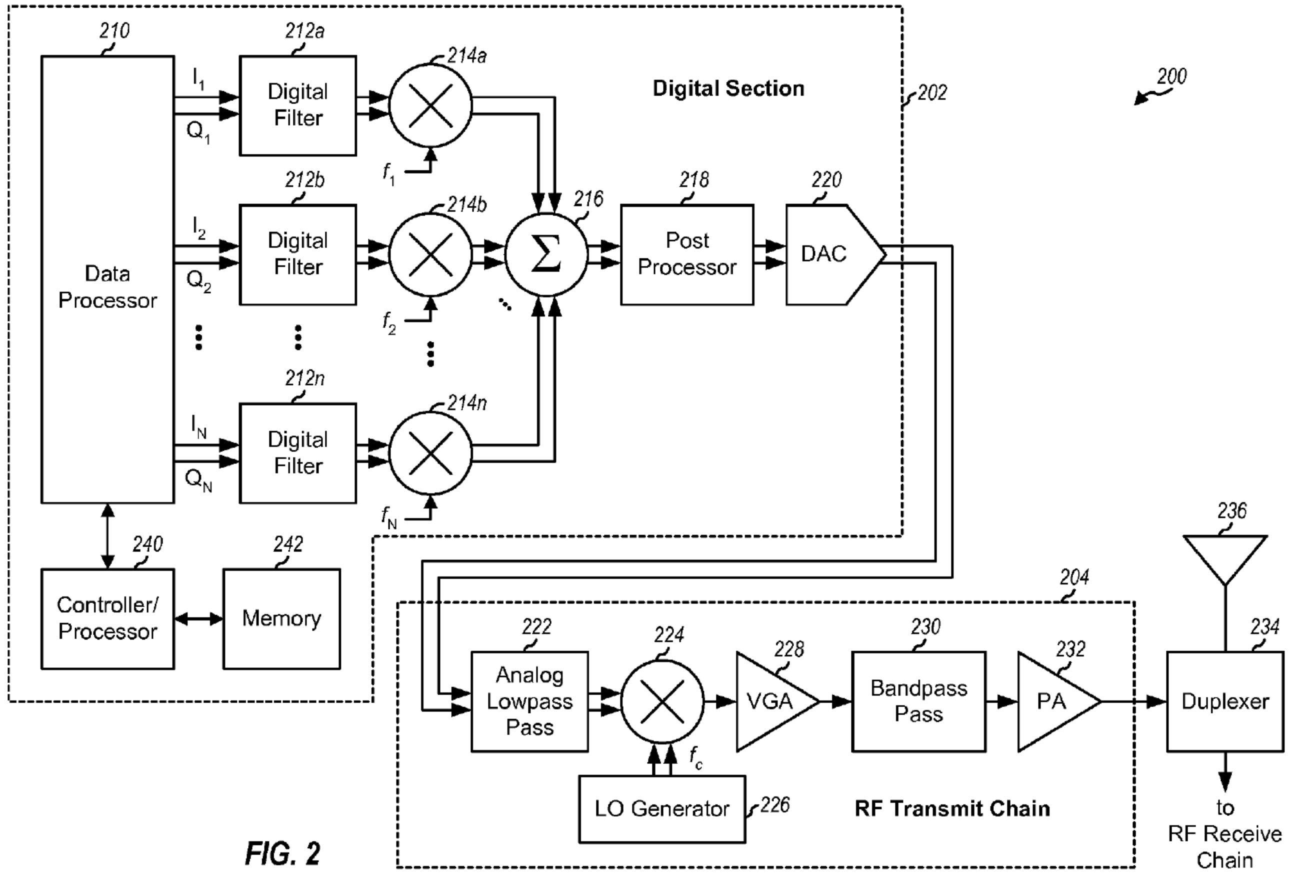
Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

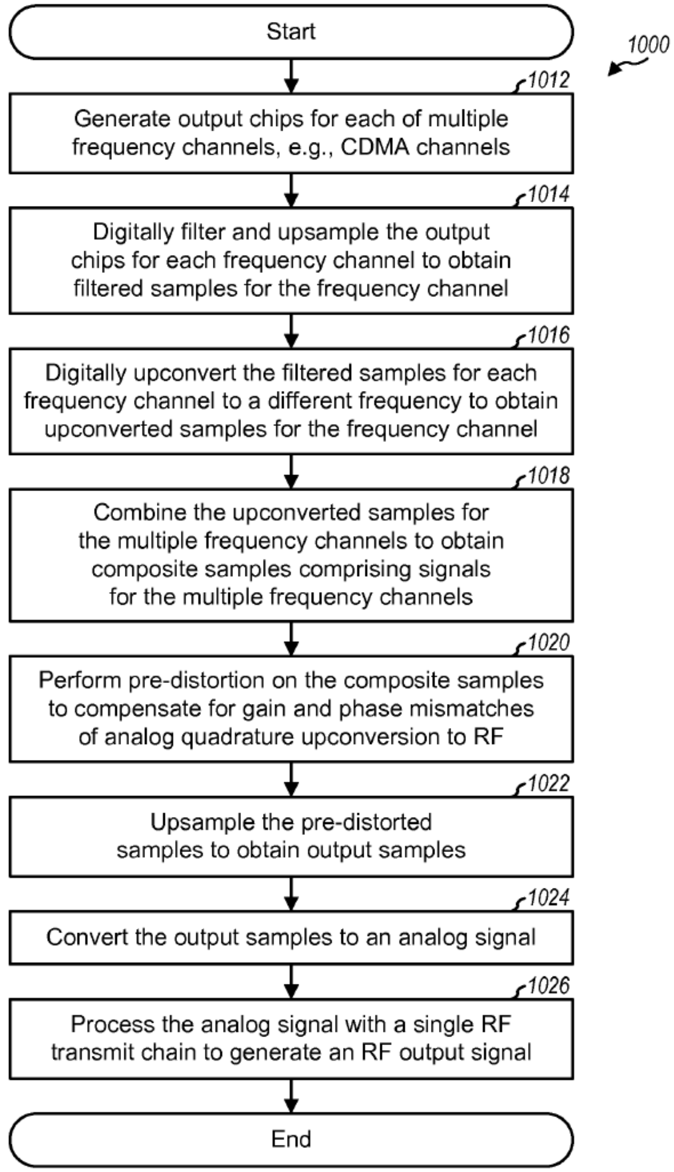
Claim 14 of the ’802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N≧1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 14 of the '802 Patent	**Prior Art Reference – Rick**
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 14 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.



1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 14 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 17 of the ’802 Patent	**Prior Art Reference – Rick**
[17.1] A wireless communication system comprising:	To the extent the preamble is limiting, Rick discloses “A wireless communication system comprising.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[17.2] a baseband digital system for providing a first digital signal comprising a first data to be transmitted and a second digital signal comprising a second data to be transmitted;	Rick discloses “a baseband digital system for providing a first digital signal comprising a first data to be transmitted and a second digital signal comprising a second data to be transmitted.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems.

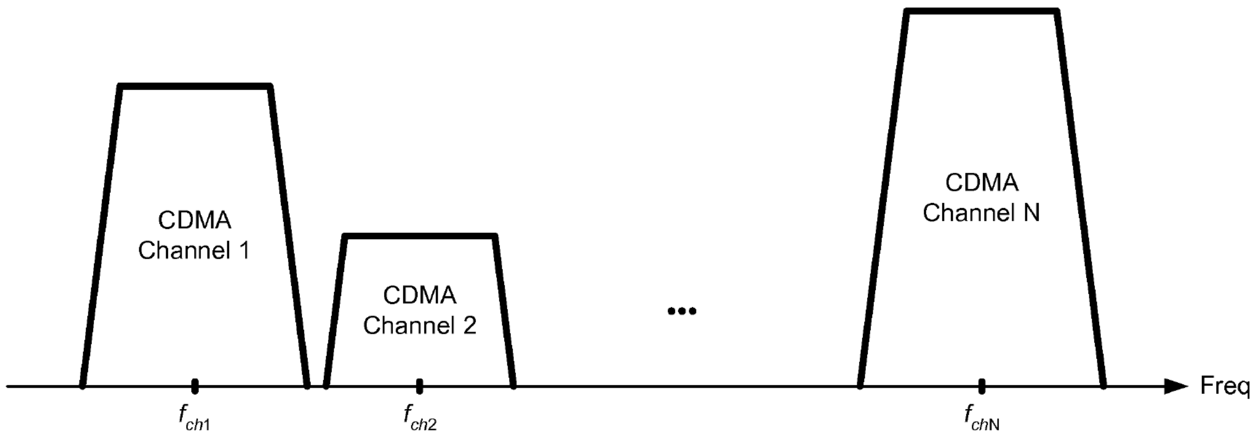
Claim 17 of the '802 Patent	Prior Art Reference – Rick
	Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal.

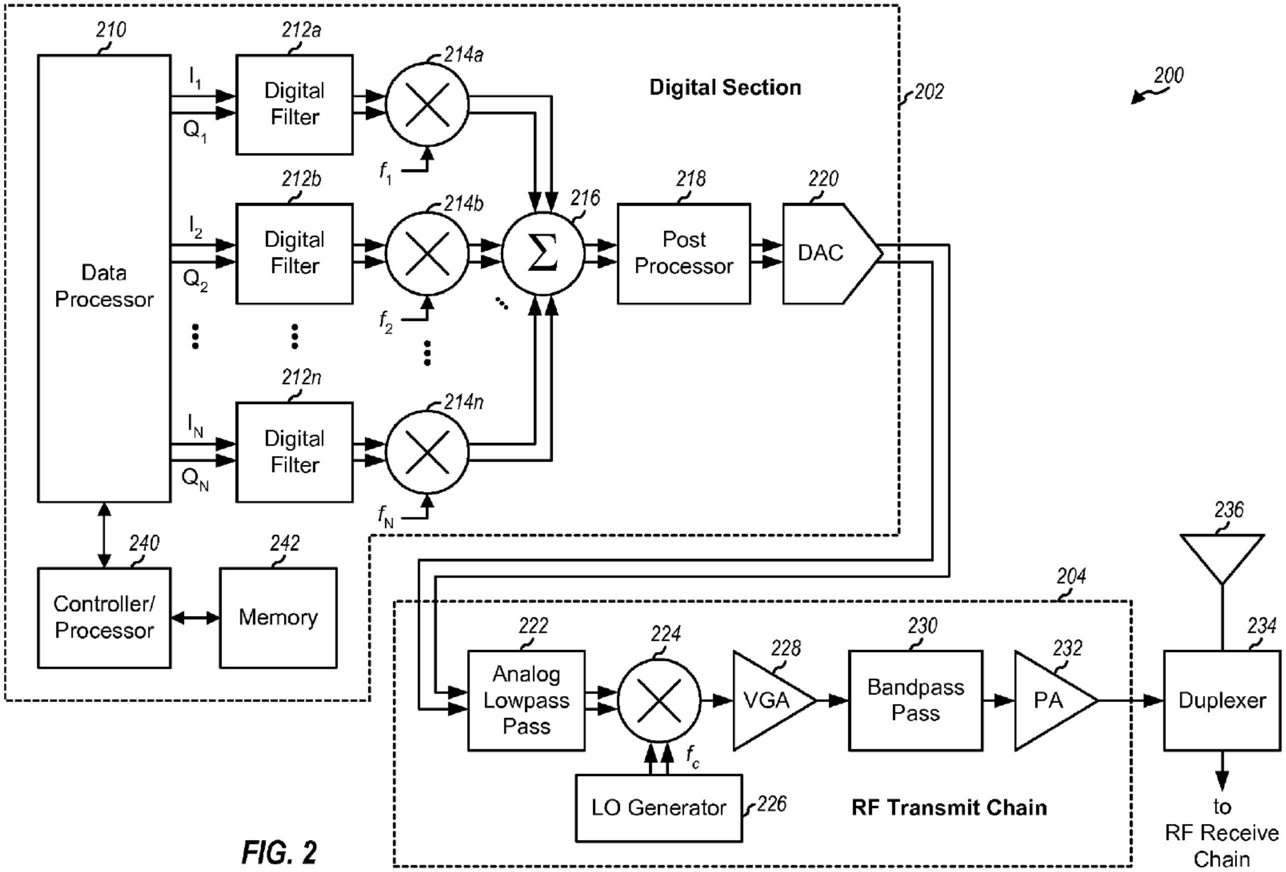
Claim 17 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See*, *e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See*, *e.g.*, Rick at 5:24-30.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	 *FIG. 1* *See*, *e.g.*, Rick at Figure 1.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

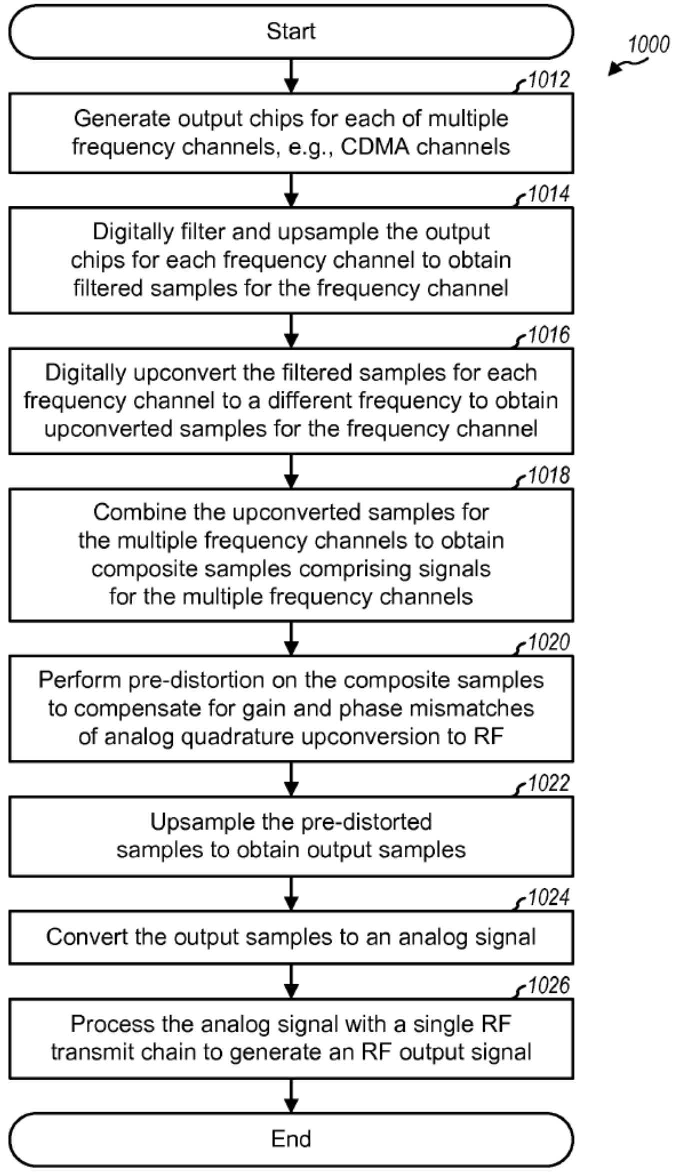

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[17.3] a first digital-to-analog converter for receiving the first digital signal and converting the first digital signal into a first analog signal, the first analog signal carrying the first data across a first frequency range;	Rick discloses “a first digital-to-analog converter for receiving the first digital signal and converting the first digital signal into a first analog signal, the first analog signal carrying the first data across a first frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

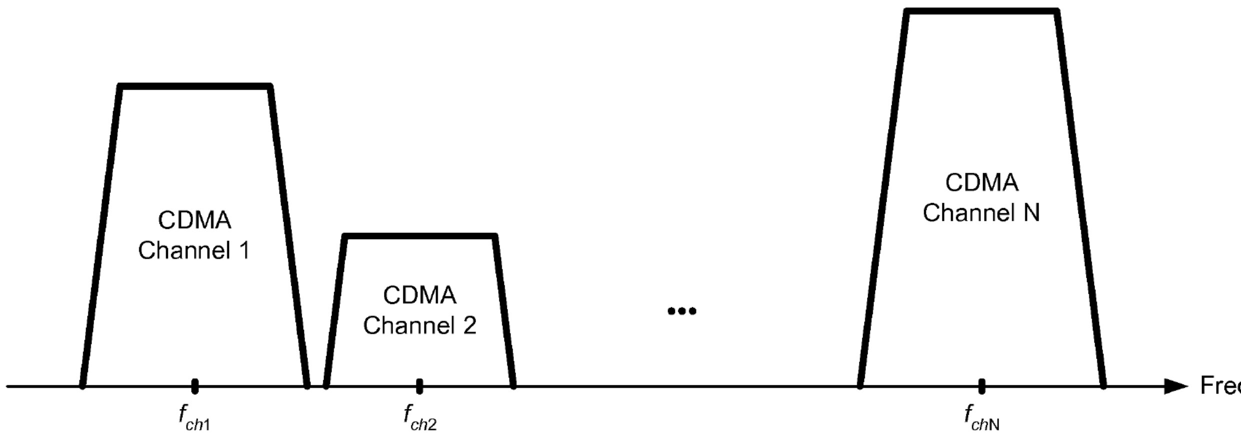
Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

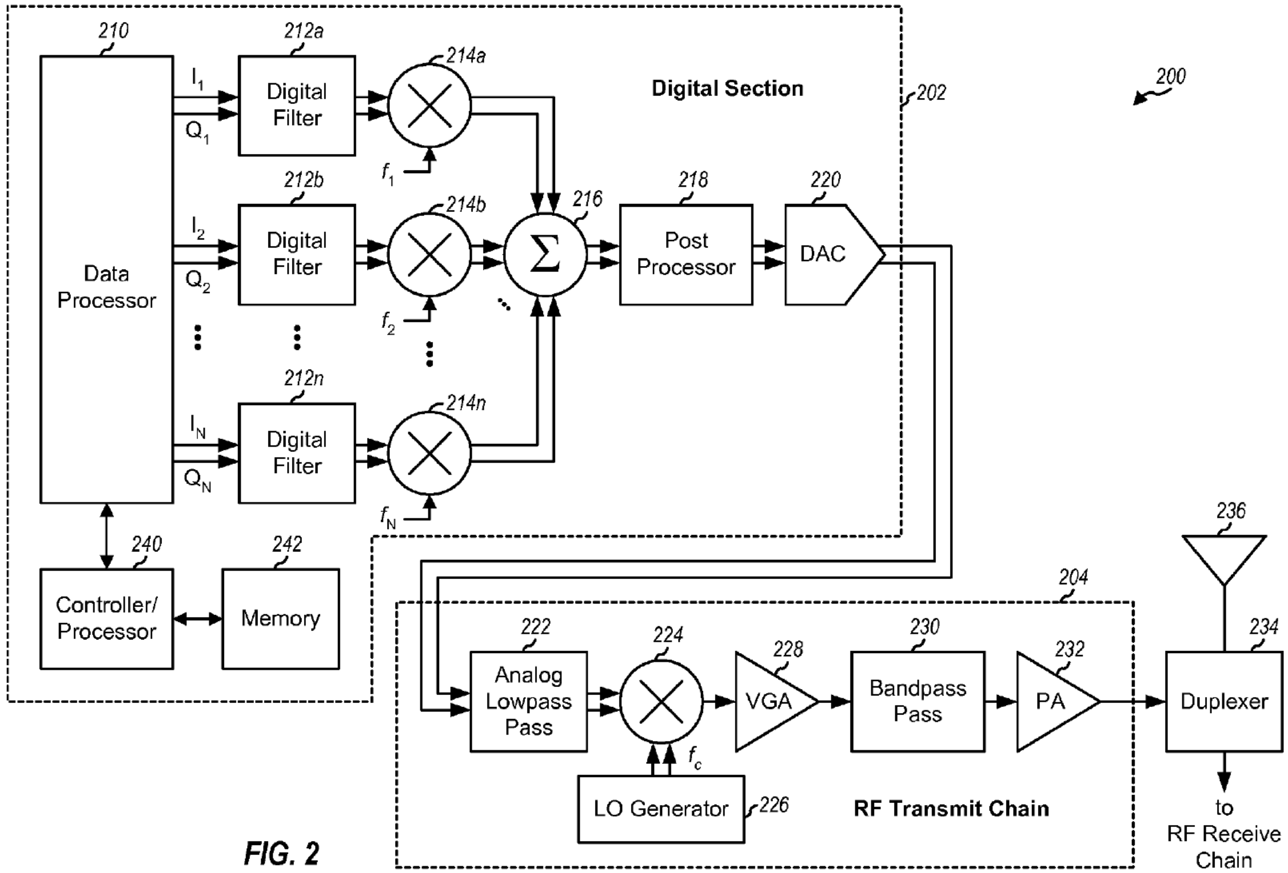
Claim 17 of the '802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

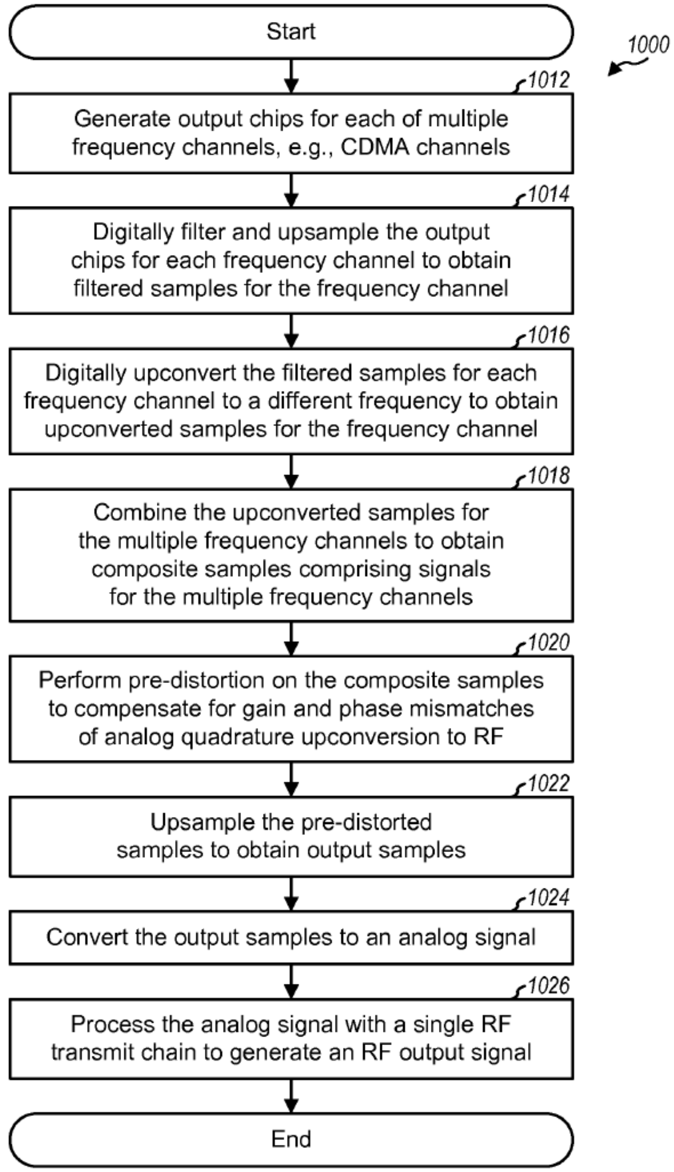

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[17.4] a second digital-to-analog converter for receiving the second digital signal and converting the second digital signal into a second analog signal, the second analog signal carrying the second data across a second frequency range;	Rick discloses "a second digital-to-analog converter for receiving the second digital signal and converting the second digital signal into a second analog signal, the second analog signal carrying the second data across a second frequency range." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

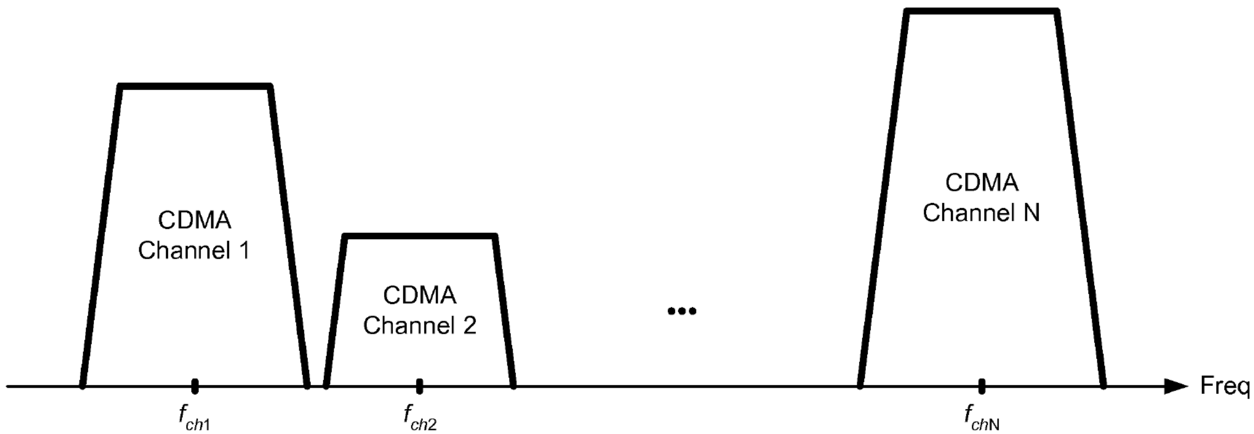
Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

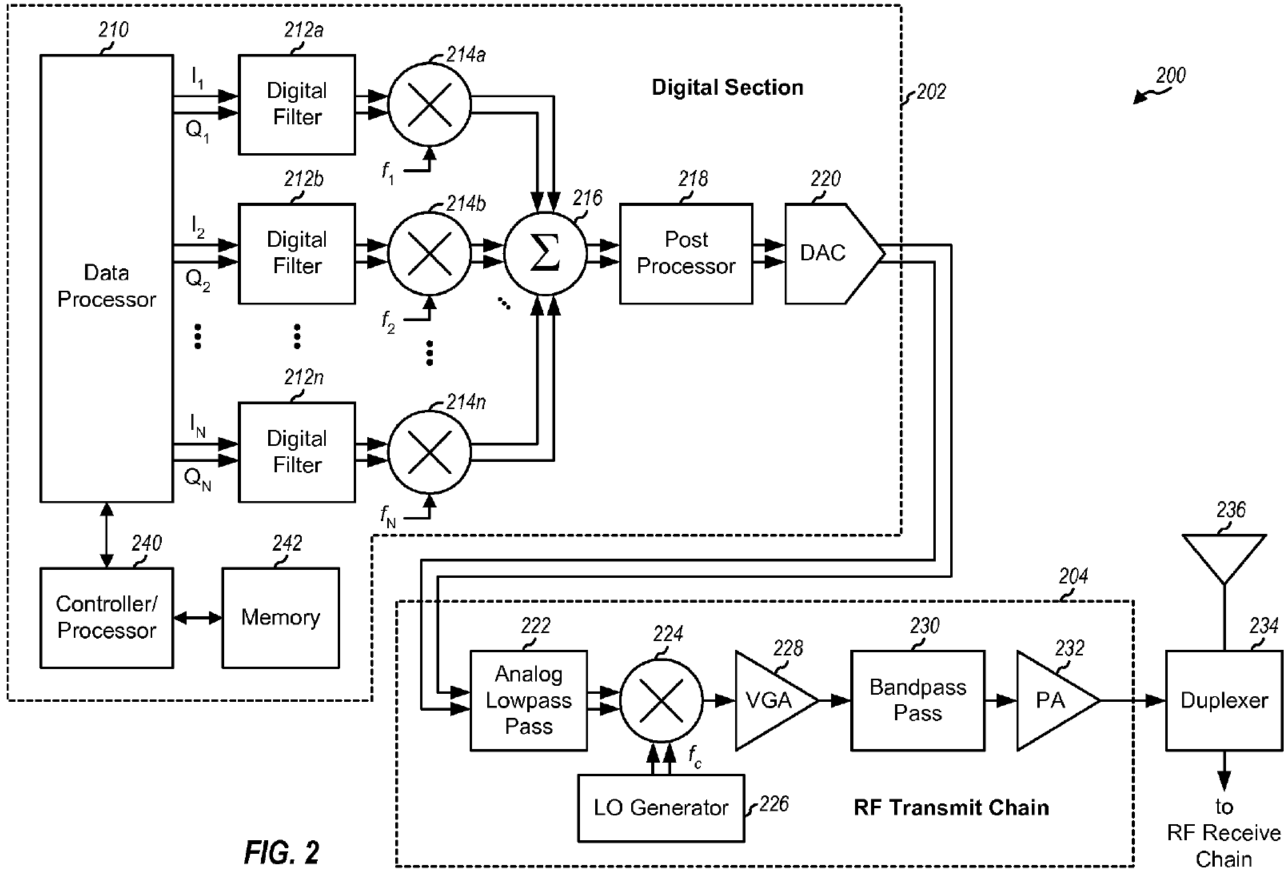
Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 *FIG. 1* *See, e.g.*, Rick at Figure 1.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	 *FIG. 2* *See, e.g.*, Rick at Figure 2.

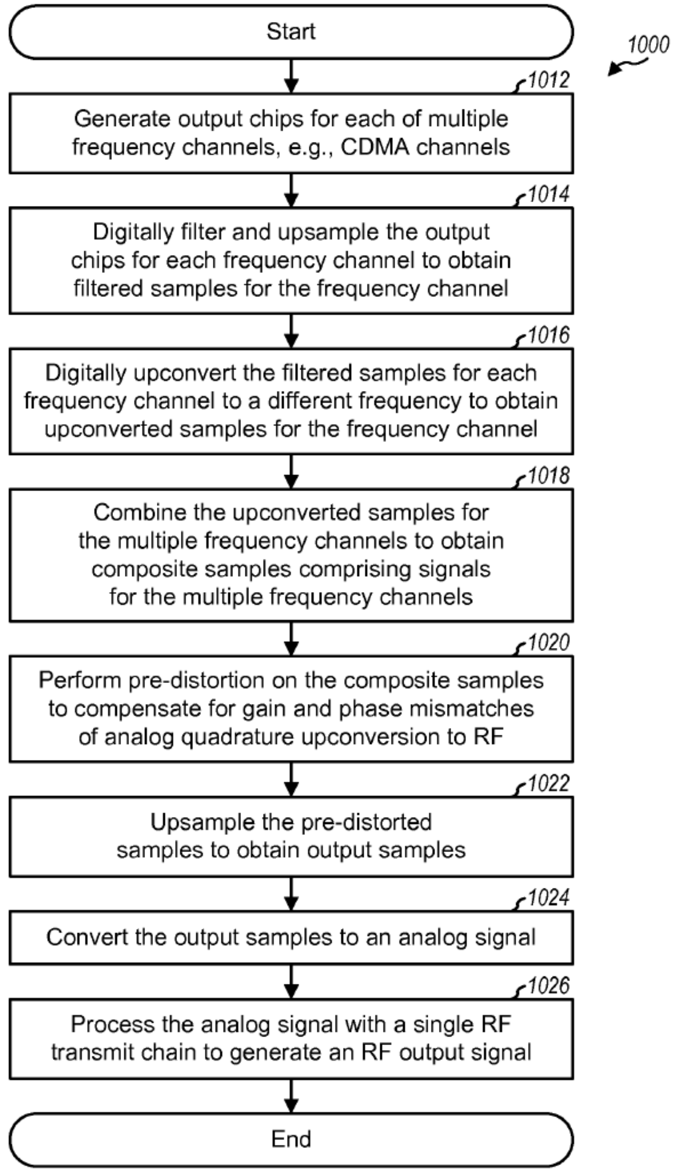

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[17.5] a first up-converter circuit having a first input coupled to receive the first analog signal and a second input coupled to receive a first modulation signal having a first RF frequency, wherein the first up-converter outputs a first up-converted analog signal comprising a first up-converted frequency range from the first RF frequency minus one-half the first frequency range to the first RF frequency plus one-half the first frequency range;	Rick discloses "a first up-converter circuit having a first input coupled to receive the first analog signal and a second input coupled to receive a first modulation signal having a first RF frequency, wherein the first up-converter outputs a first up-converted analog signal comprising a first up-converted frequency range from the first RF frequency minus one-half the first frequency range to the first RF frequency plus one-half the first frequency range." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

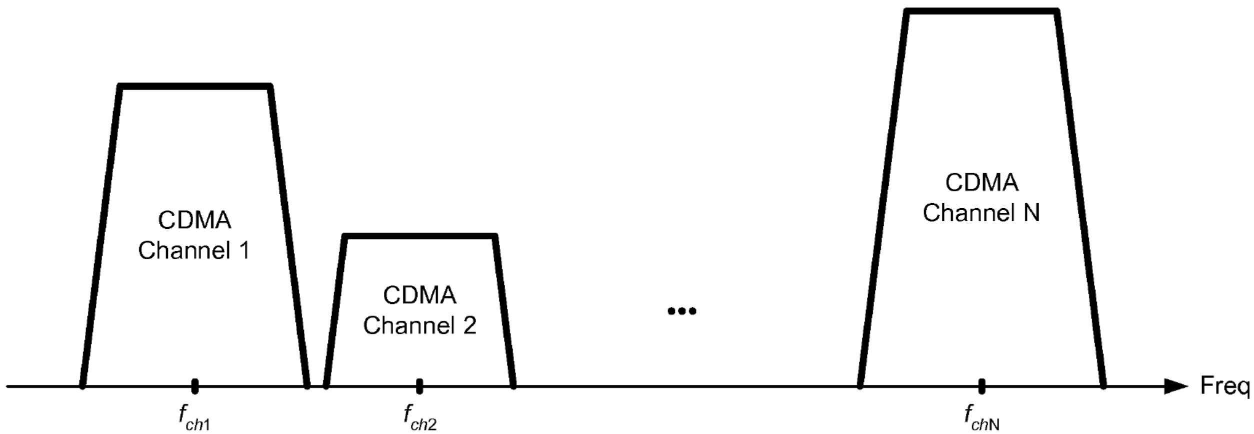
Claim 17 of the '802 Patent	**Prior Art Reference – Rick**
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples,

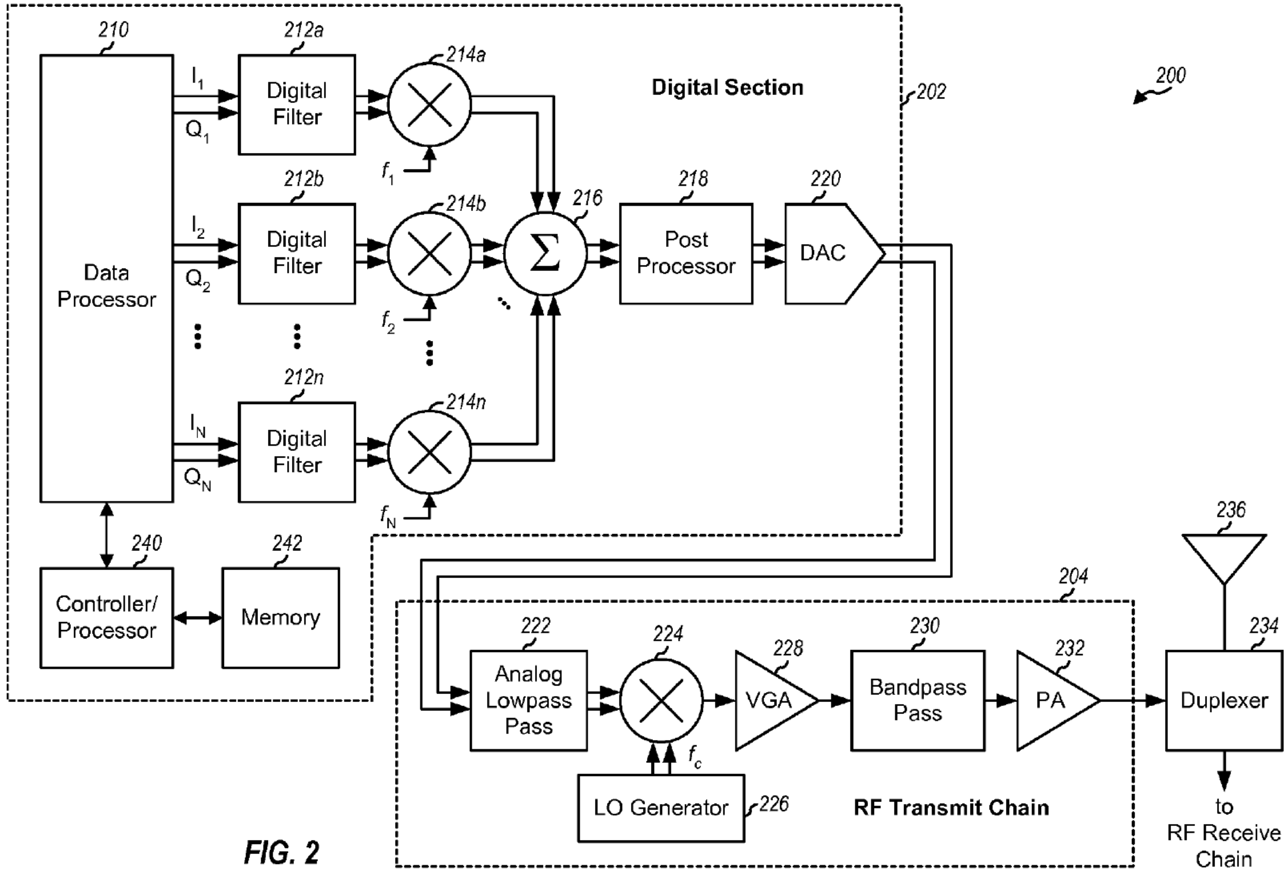
Claim 17 of the ’802 Patent	**Prior Art Reference – Rick**
	perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below.

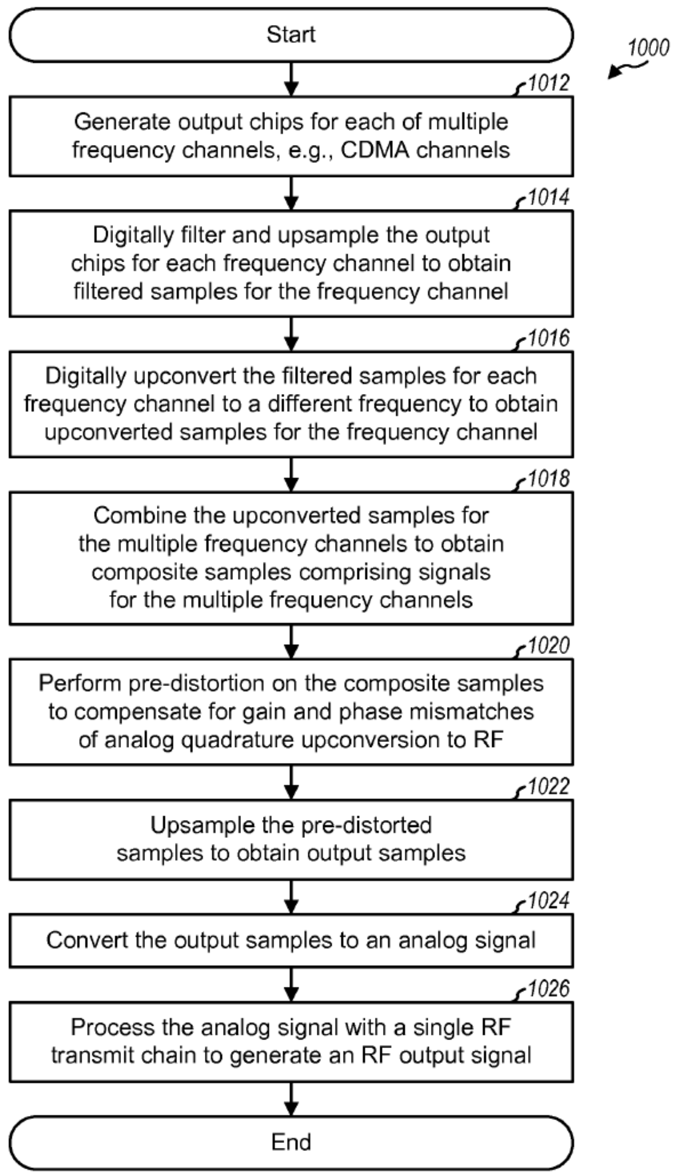
Claim 17 of the '802 Patent	Prior Art Reference – Rick
	The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.



1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 17 of the ’802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[17.6] a second up-converter circuit having a first input coupled to receive the second analog signal and a second input coupled to receive a second modulation signal having a second RF frequency, wherein the second up-converter outputs a second up-converted analog signal comprising a second up-converted frequency range from the second RF frequency minus one-half the second frequency range to the second RF frequency plus one-half the second frequency range, and wherein frequency difference between the first RF frequency and the second RF frequency is greater than	Rick discloses “a second up-converter circuit having a first input coupled to receive the second analog signal and a second input coupled to receive a second modulation signal having a second RF frequency, wherein the second up-converter outputs a second up-converted analog signal comprising a second up-converted frequency range from the second RF frequency minus one-half the second frequency range to the second RF frequency plus one-half the second frequency range, and wherein frequency difference between the first RF frequency and the second RF frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

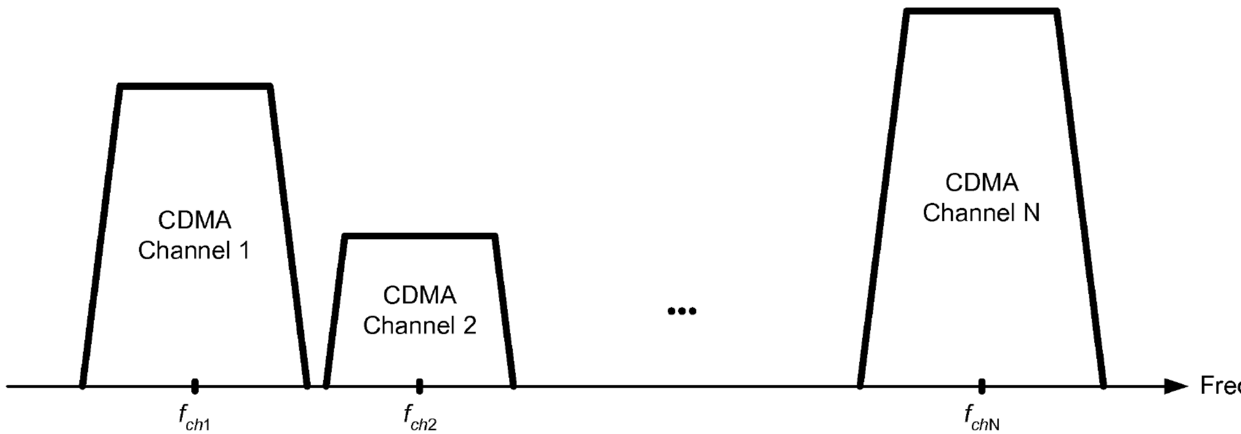
Claim 17 of the ’802 Patent	**Prior Art Reference – Rick**
the sum of one-half the first frequency range and one-half the second frequency range; and	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may

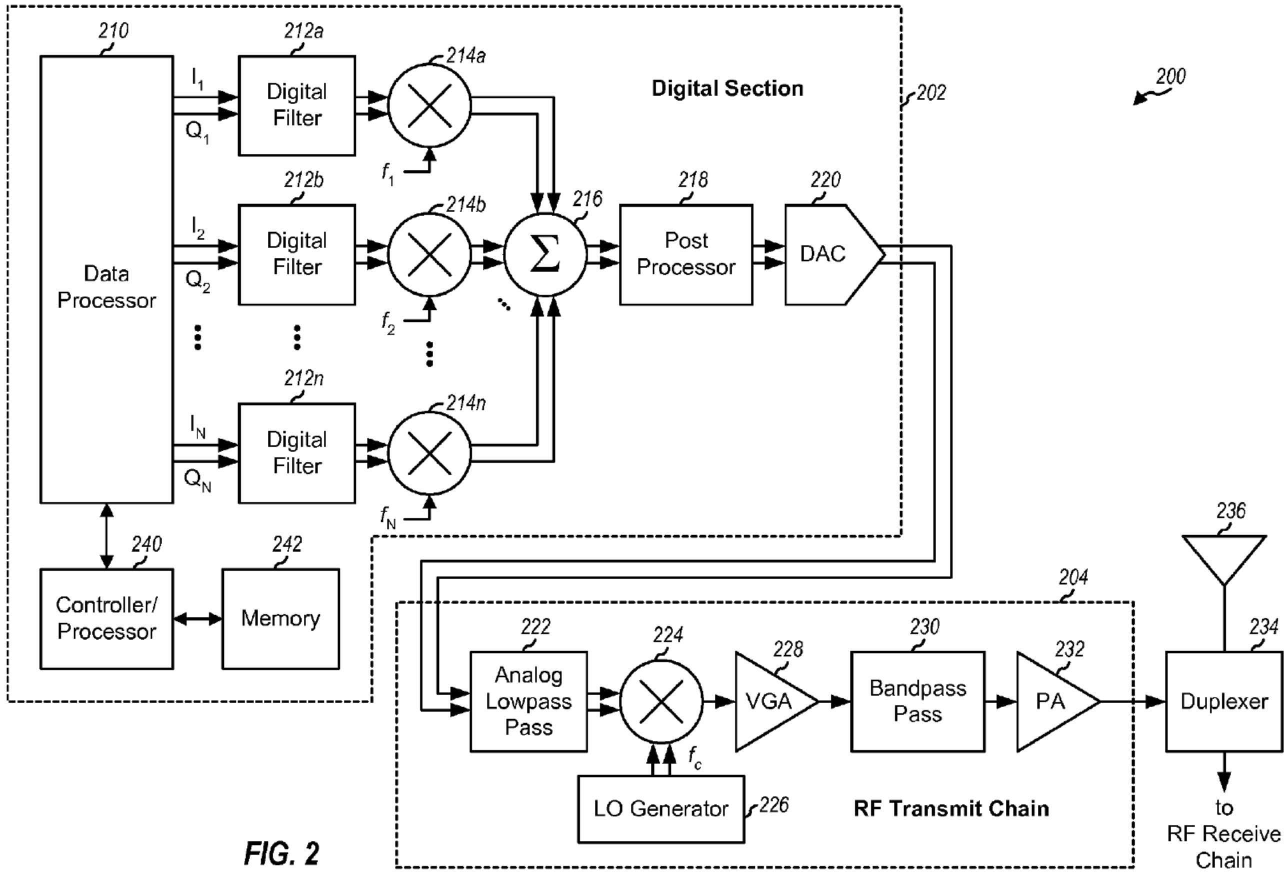
Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

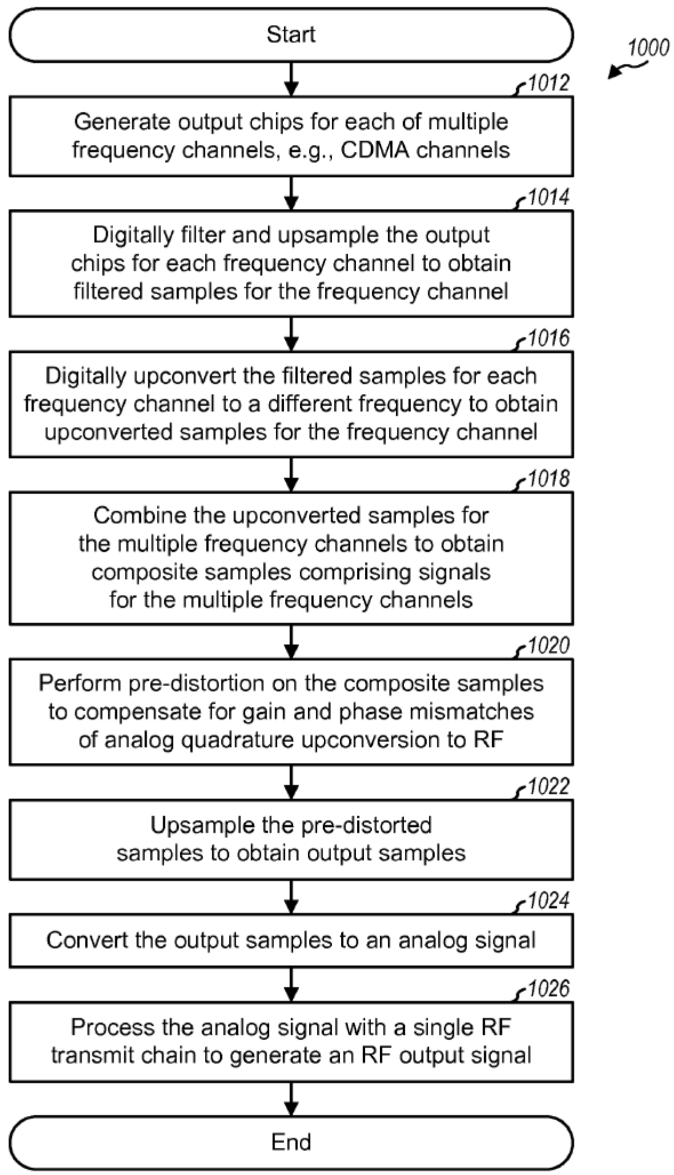

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[17.7] a power amplifier coupled to receive the first and second up-converted analog signals, wherein the bandwidth of the power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.	Rick discloses “a power amplifier coupled to receive the first and second up-converted analog signals, wherein the bandwidth of the power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access

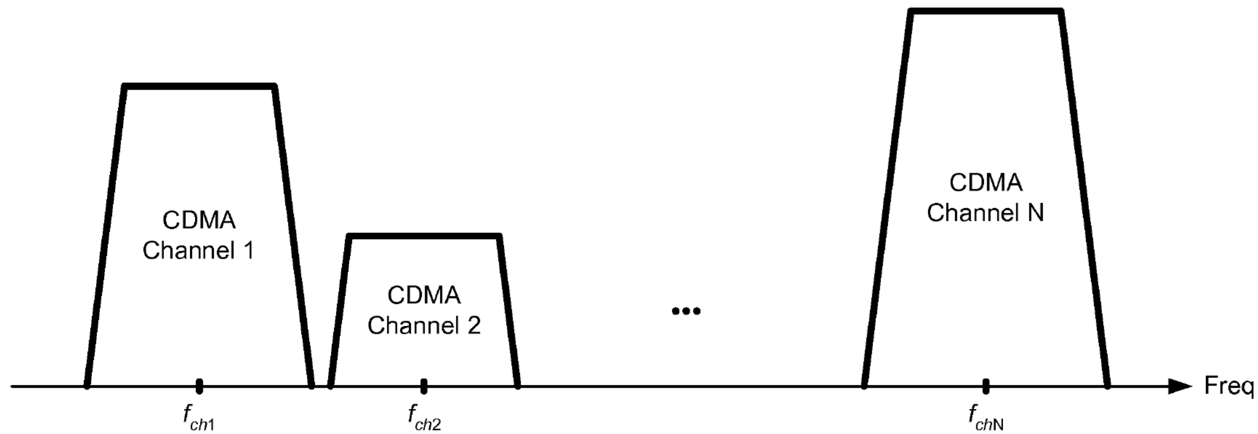
Claim 17 of the '802 Patent	Prior Art Reference – Rick
	systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output

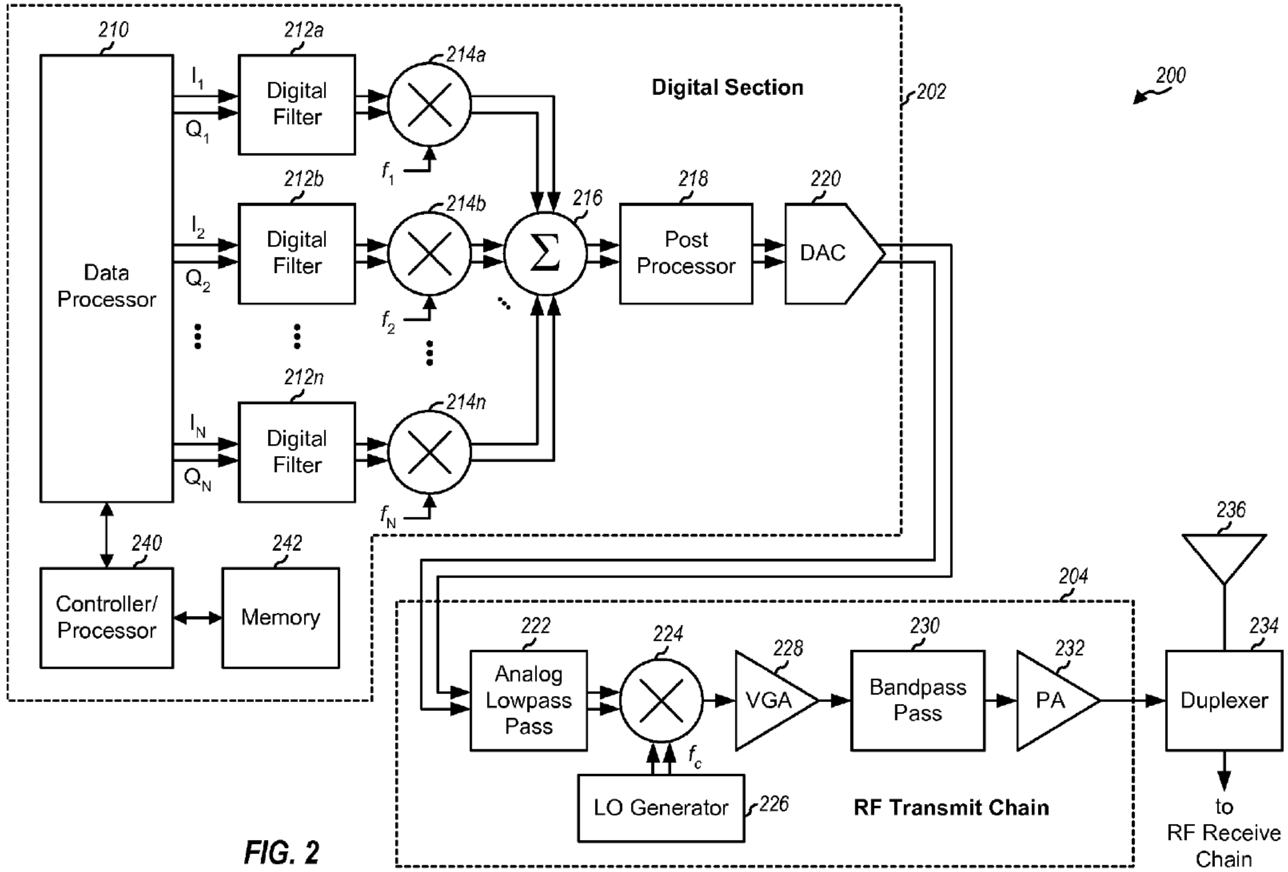
Claim 17 of the ’802 Patent	**Prior Art Reference – Rick**
	samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	 **FIG. 1** *See, e.g.*, Rick at Figure 1.

Claim 17 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

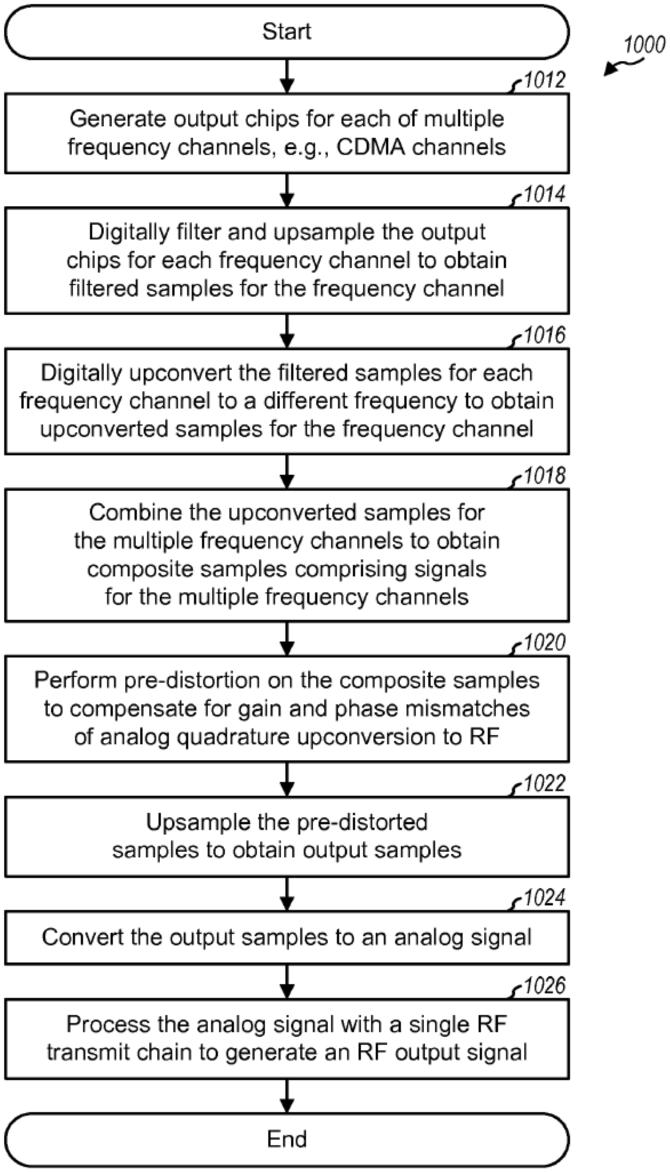

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 17 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 21 of the ’802 Patent	Prior Art Reference – Rick
[21.1] The communication system of claim 17	Rick discloses all the elements of claim 17 for all the reasons provided above.
[21.2] wherein the first data of the first digital signal is encoded using a first wireless protocol and the first data of the second digital signal is encoded using a second wireless protocol.	Rick discloses “wherein the first data of the first digital signal is encoded using a first wireless protocol and the first data of the second digital signal is encoded using a second wireless protocol.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal.

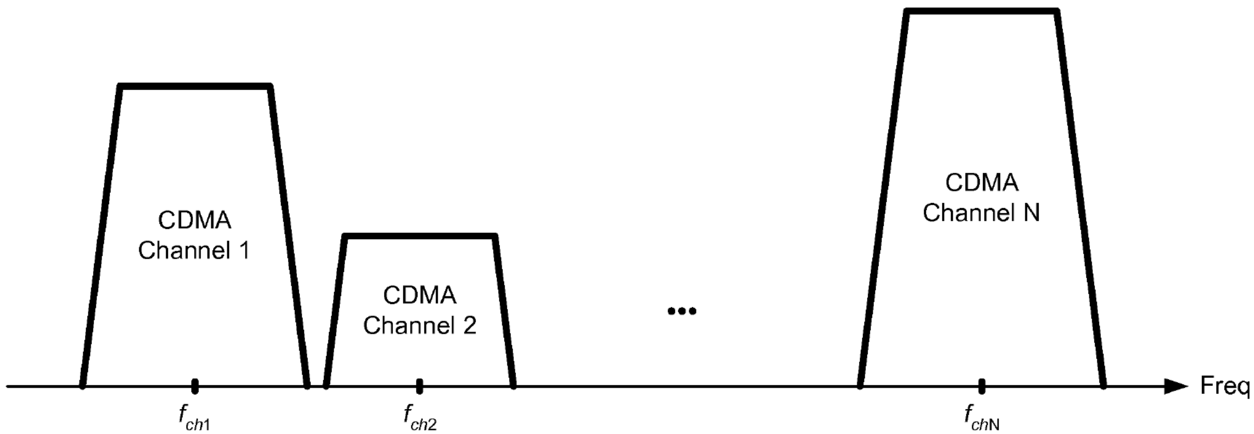
Claim 21 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each

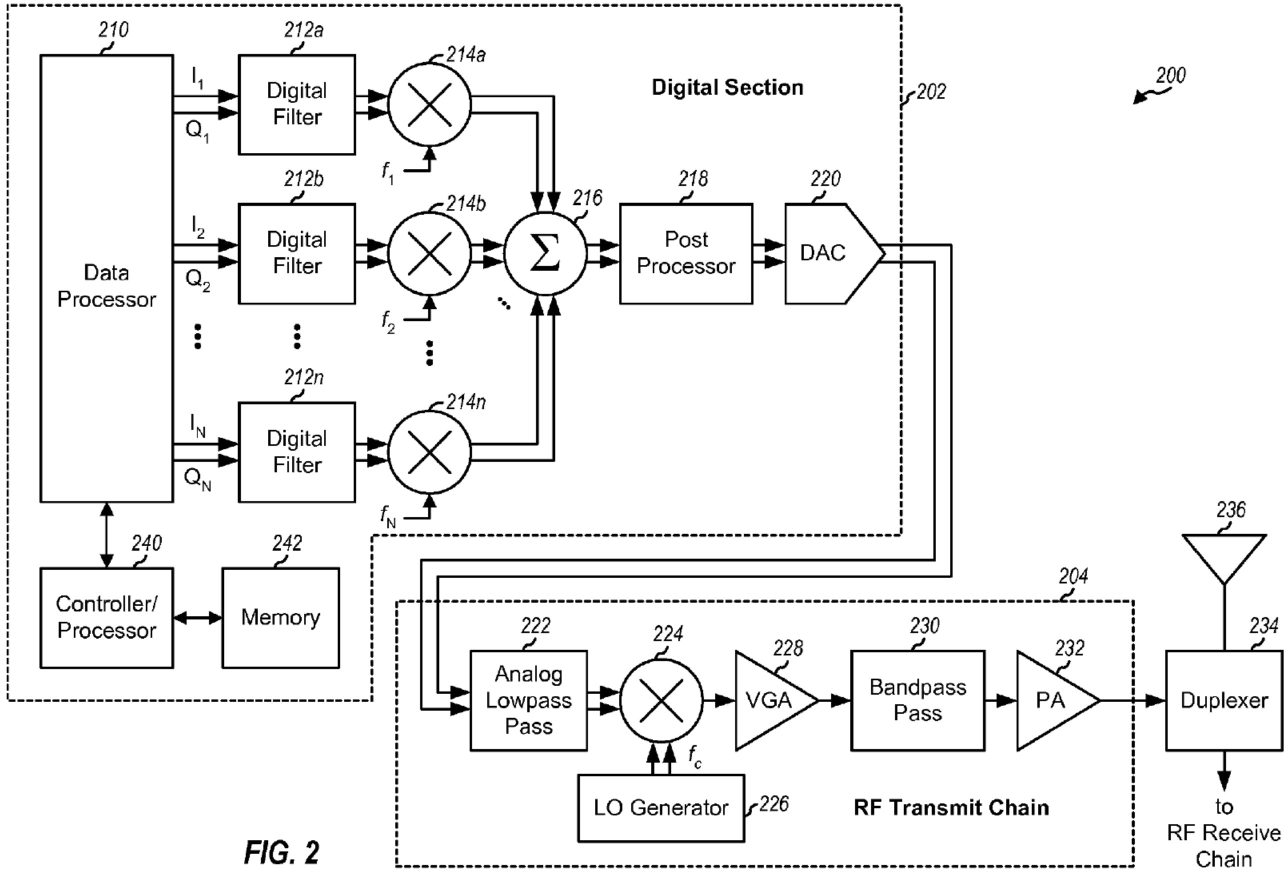
Claim 21 of the ’802 Patent	Prior Art Reference – Rick
	frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 21 of the ’802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 21 of the '802 Patent	**Prior Art Reference – Rick**
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 21 of the '802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 21 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 21 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

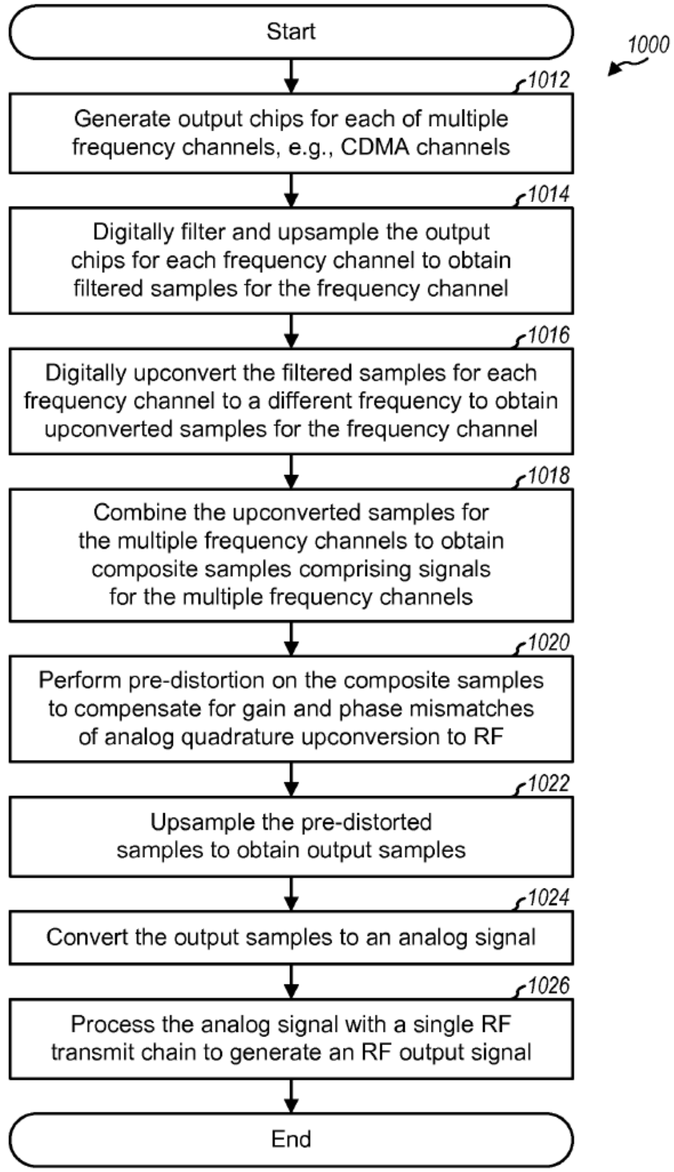

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 21 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 22 of the ’802 Patent	Prior Art Reference – Rick
[22.1] The communication system of claim 17	Rick discloses all the elements of claim 17 for all the reasons provided above.
[22.2] wherein the second data corresponds to the first data and wherein the power amplifier outputs a third up-converted signal comprising the up-converted first analog signal and the up-converted second analog signal.	Rick discloses “wherein the second data corresponds to the first data and wherein the power amplifier outputs a third up-converted signal comprising the up-converted first analog signal and the up-converted second analog signal.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal.

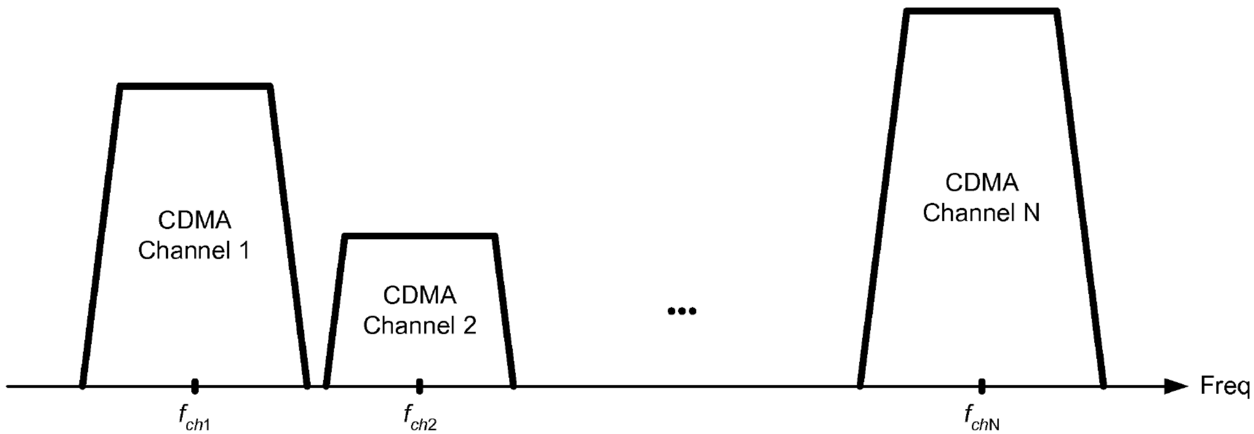
Claim 22 of the ’802 Patent	Prior Art Reference – Rick
	See, *e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each

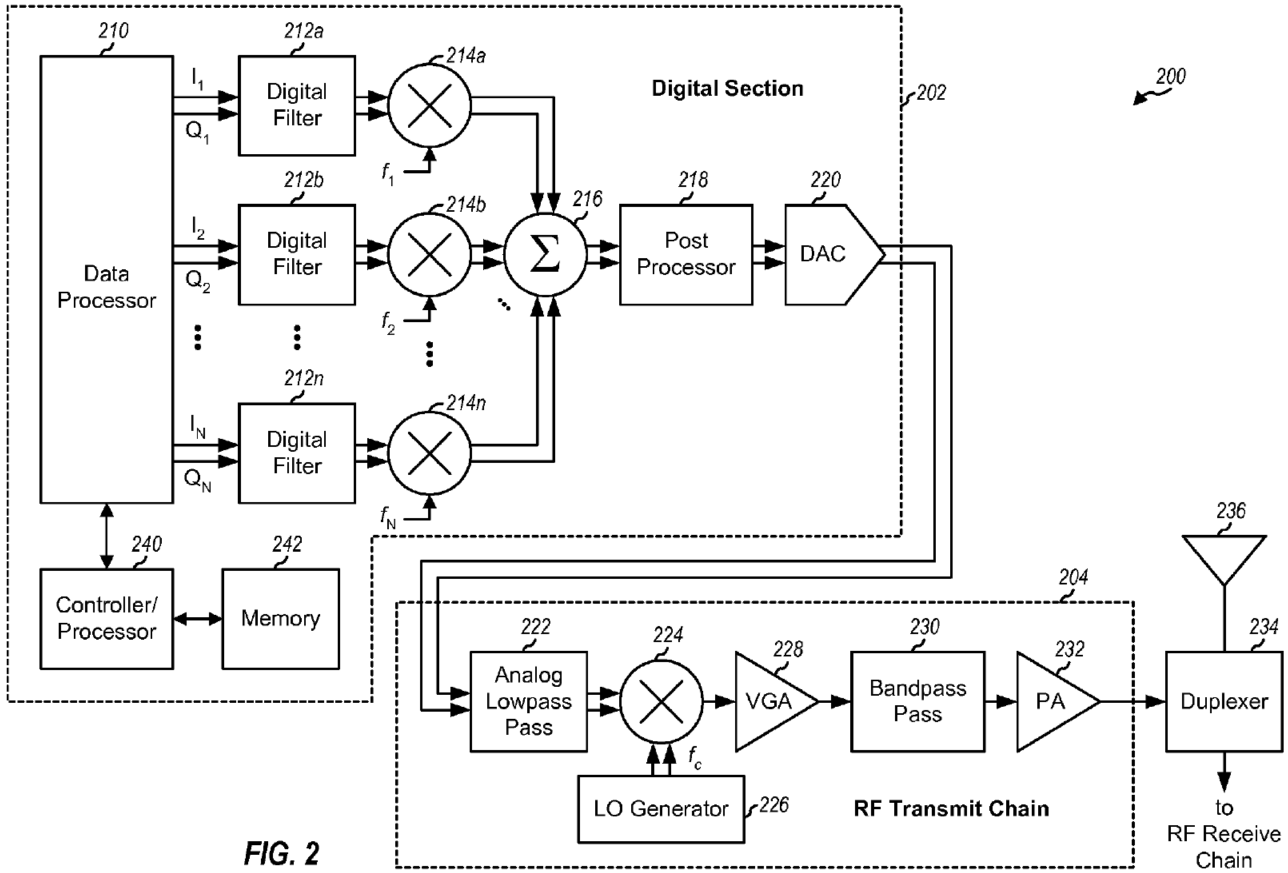
Claim 22 of the ’802 Patent	Prior Art Reference – Rick
	frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless

Claim 22 of the '802 Patent	Prior Art Reference – Rick
	modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where $N \geqq 1$ in general and $N>1$ for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See*, *e.g.*, Rick at 3:1-47.

Claim 22 of the '802 Patent	Prior Art Reference – Rick
	Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal

Claim 22 of the ’802 Patent	Prior Art Reference – Rick
	from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 22 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 22 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

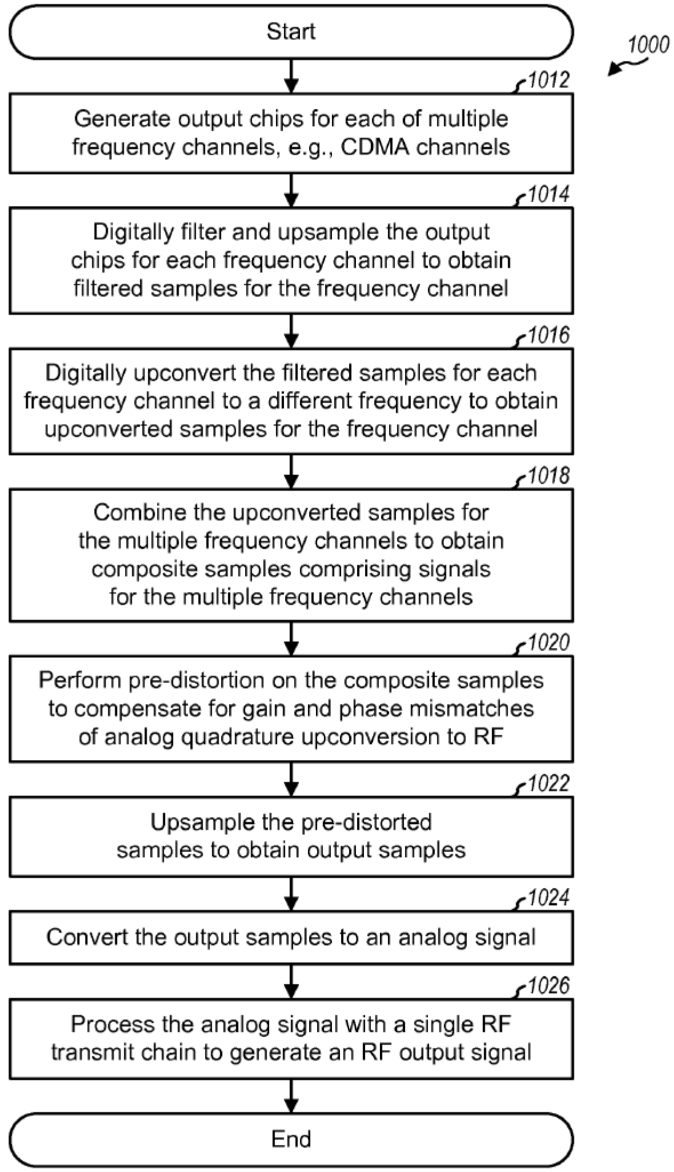

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 22 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

Claim 23 of the ’802 Patent	Prior Art Reference – Rick
[23.1] The communication system of claim 17	Rick discloses all the elements of claim 17 for all the reasons provided above.
[23.2] wherein first and second data to be transmitted comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first up-converted frequency range and a second symbol is transmitted during the first time slot across the second up-converted frequency range, and wherein a third symbol is transmitted during a second time slot across the first up-converted frequency range and a fourth symbol is	Rick discloses “wherein first and second data to be transmitted comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first up-converted frequency range and a second symbol is transmitted during the first time slot across the second up-converted frequency range, and wherein a third symbol is transmitted during a second time slot across the first up-converted frequency range and a fourth symbol is transmitted during the second time slot across a second up-converted frequency range.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog

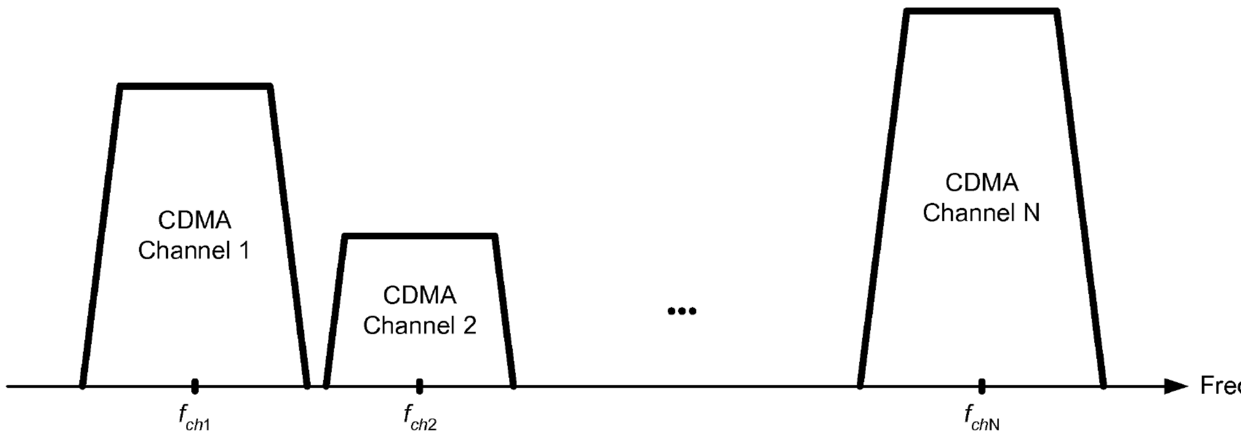
Claim 23 of the '802 Patent	Prior Art Reference – Rick
transmitted during the second time slot across a second up-converted frequency range.	signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each

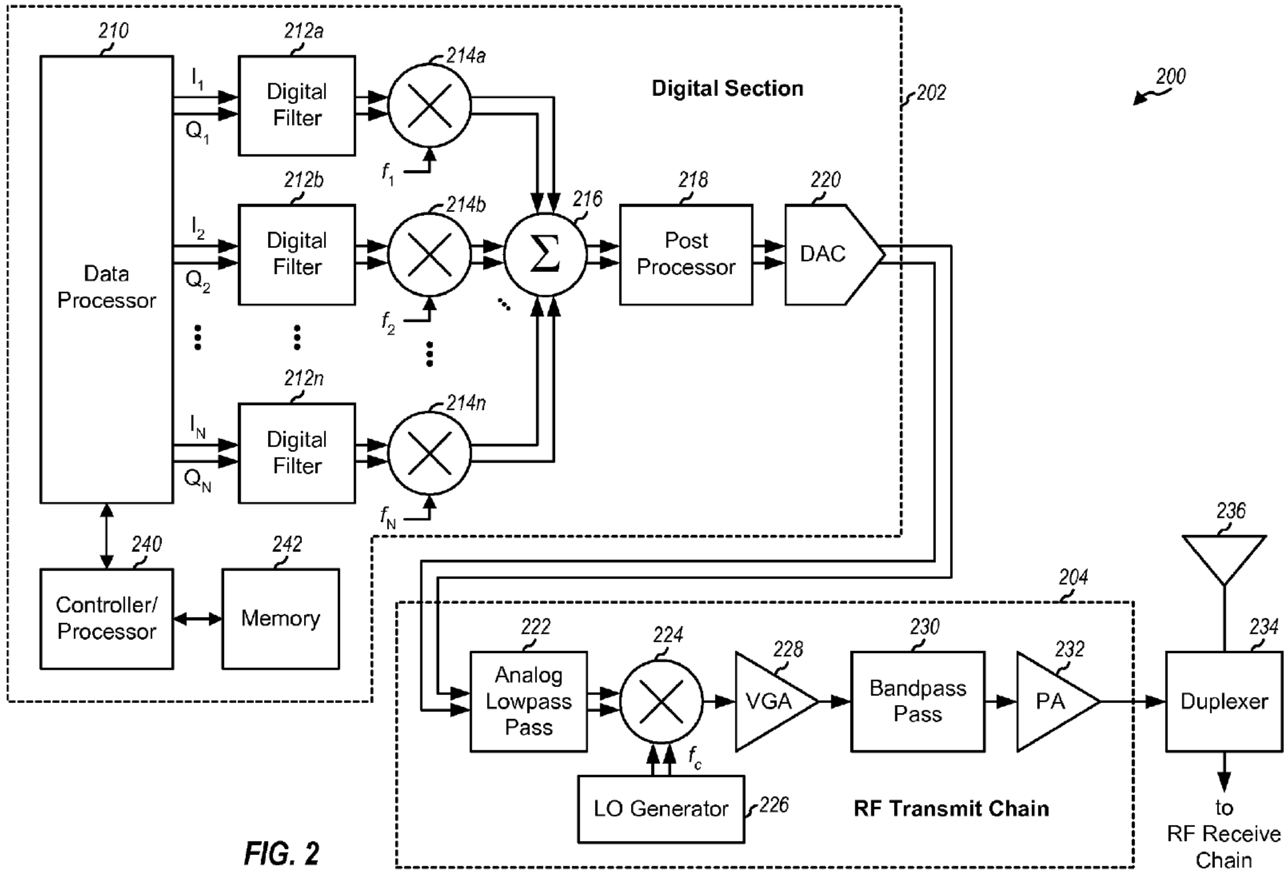
Claim 23 of the ’802 Patent	Prior Art Reference – Rick
	frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or

Claim 23 of the '802 Patent	Prior Art Reference – Rick
	mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal.

Claim 23 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analo g LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture.

Claim 23 of the '802 Patent	Prior Art Reference – Rick
	Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 23 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 23 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2.

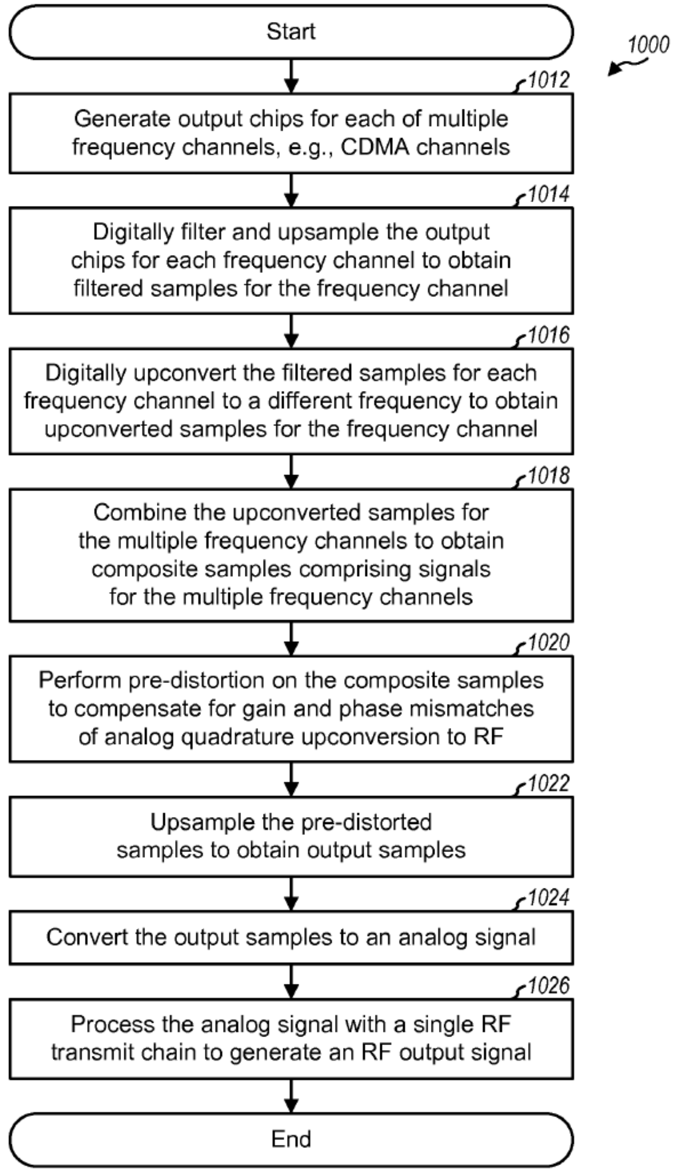

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 23 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.

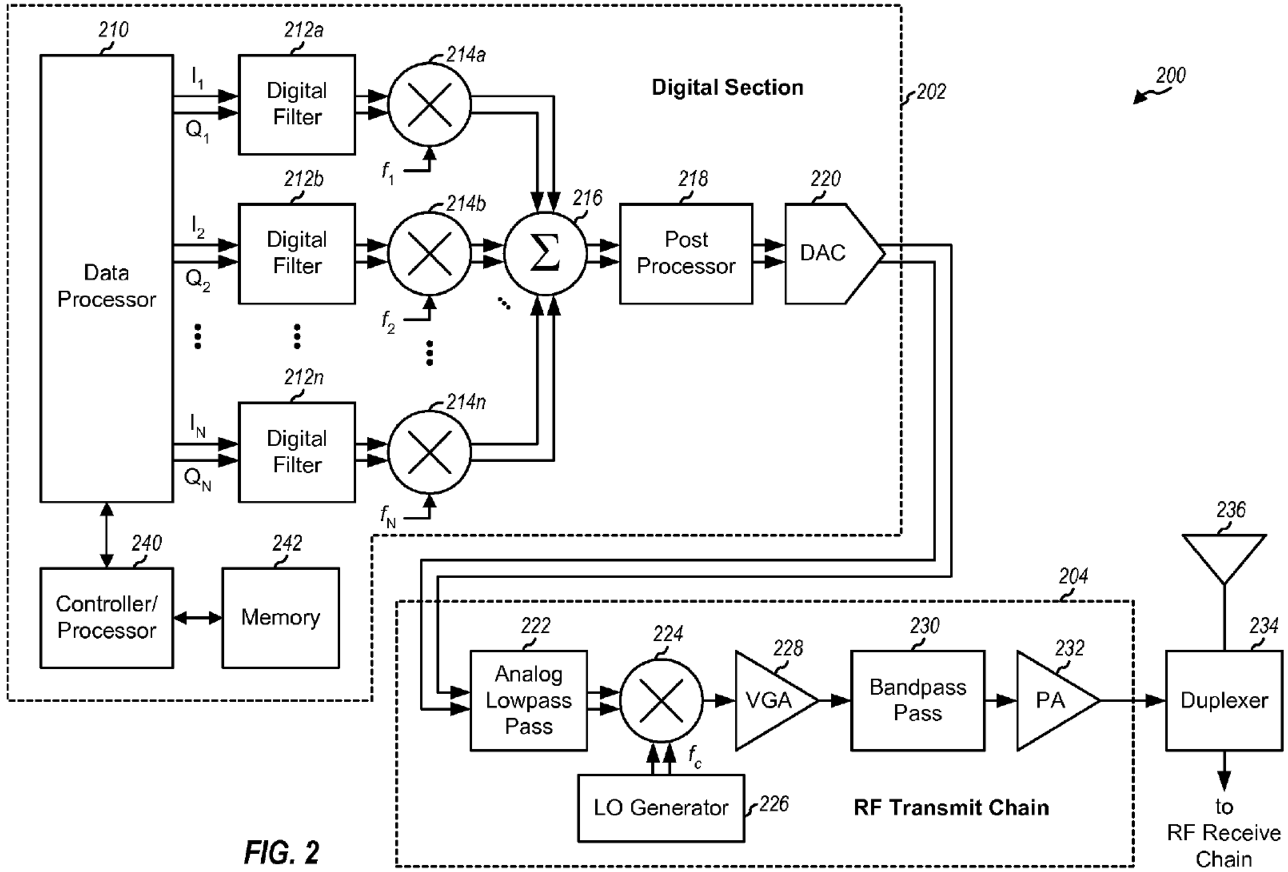
Claim 24 of the ’802 Patent	Prior Art Reference – Rick
[24.1] An electronic circuit comprising:	To the extent the preamble is limiting, Rick discloses “An electronic circuit comprising.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

Claim 24 of the ’802 Patent	**Prior Art Reference – Rick**
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier.

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See*, *e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See*, *e.g.*, Rick at 5:24-30.

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See, e.g.*, Rick at Figure 2. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[24.2] a first down-converter circuit having a first input coupled to receive a first up-converted signal, a second input coupled to receive a first demodulation signal having a first RF frequency, and an output, wherein the first down-converter circuit outputs a first down-converted signal on the first down-converter output;	Rick discloses “a first down-converter circuit having a first input coupled to receive a first up-converted signal, a second input coupled to receive a first demodulation signal having a first RF frequency, and an output, wherein the first down-converter circuit outputs a first down-converted signal on the first down-converter output.” See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems.

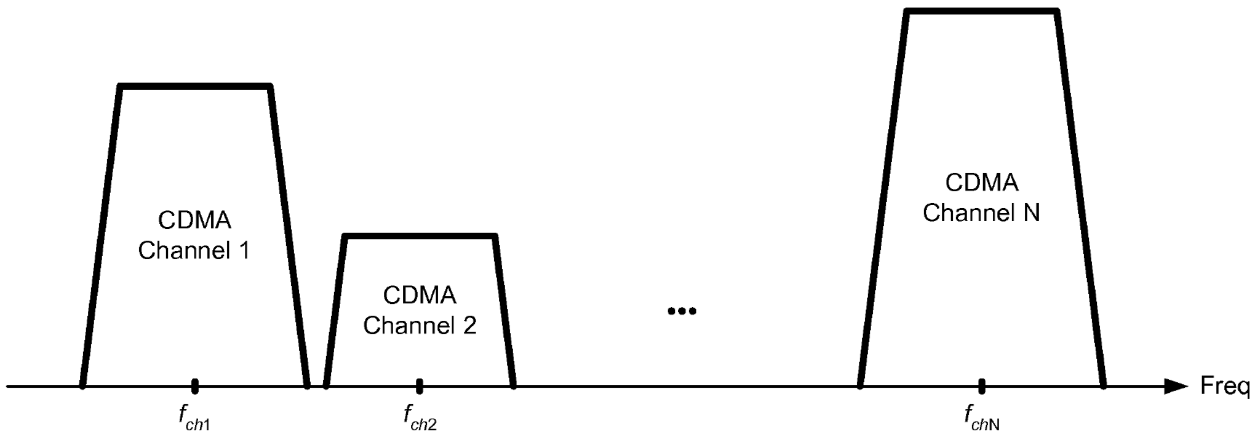
Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See*, *e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9.

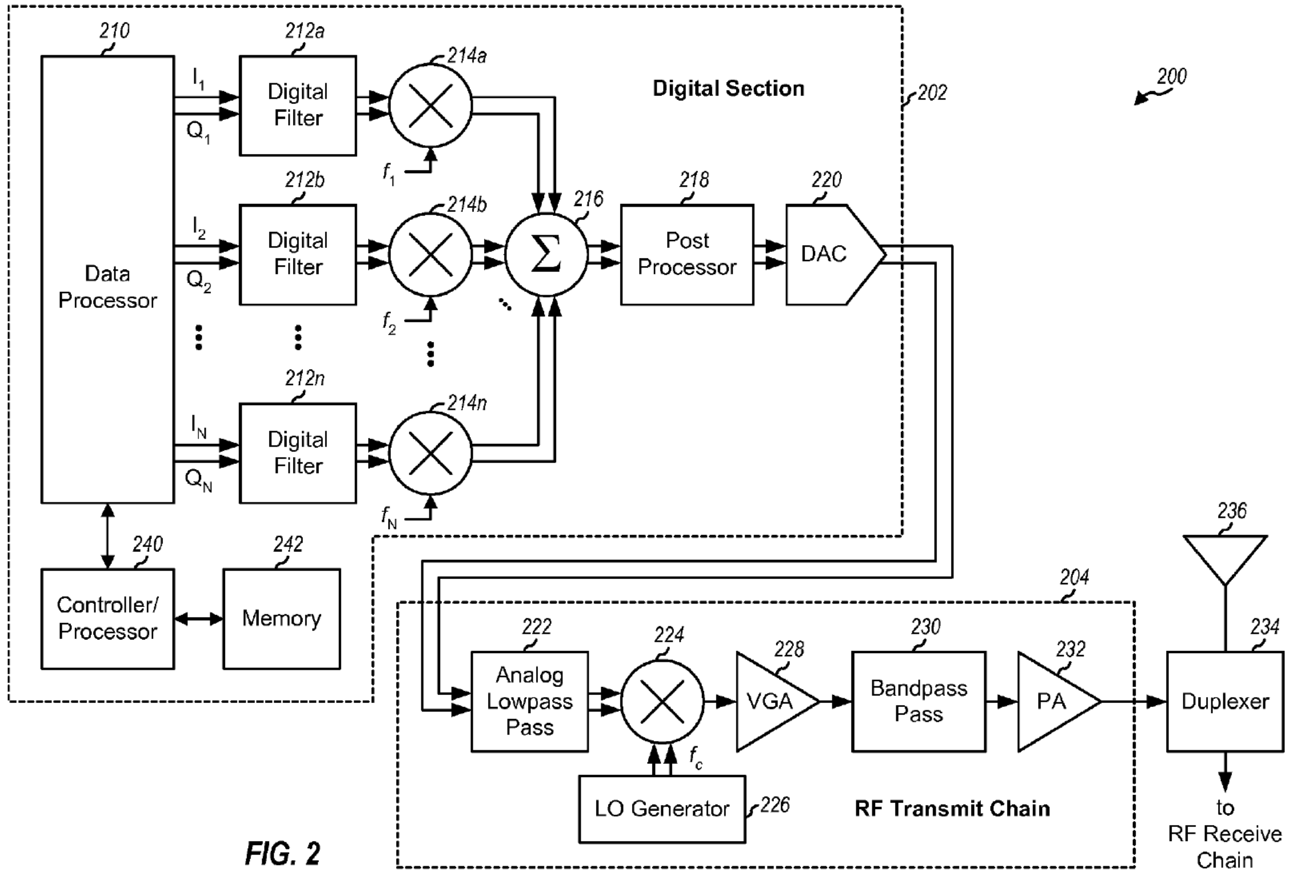
Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier.

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

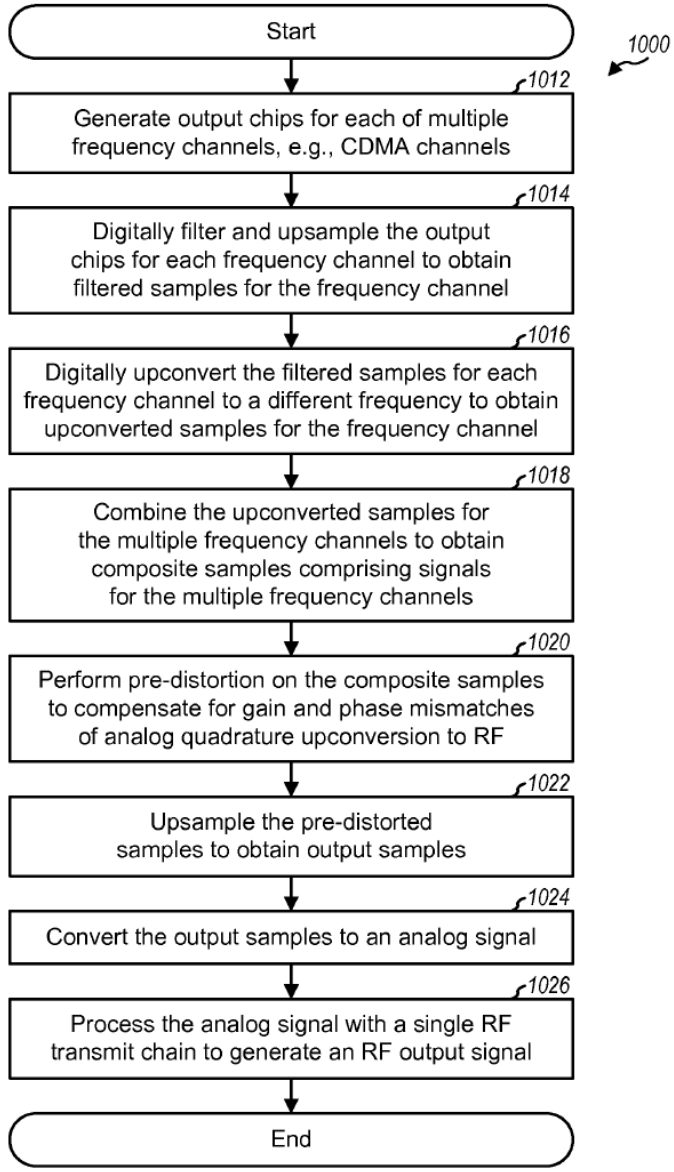

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[24.3] a second down-converter circuit having a first input coupled to receive the first up-converted signal, a second input coupled to receive a second demodulation signal having a second RF frequency different than the first RF frequency, and an output, wherein the second down-converter outputs a second down-converted signal on the second down-converter output, wherein the first up-converted signal comprises a first signal modulated at the first RF frequency and a second signal modulated at the second RF frequency; and	Rick discloses "a second down-converter circuit having a first input coupled to receive the first up-converted signal, a second input coupled to receive a second demodulation signal having a second RF frequency different than the first RF frequency, and an output, wherein the second down-converter outputs a second down-converted signal on the second down-converter output, wherein the first up-converted signal comprises a first signal modulated at the first RF frequency and a second signal modulated at the second RF frequency." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract.

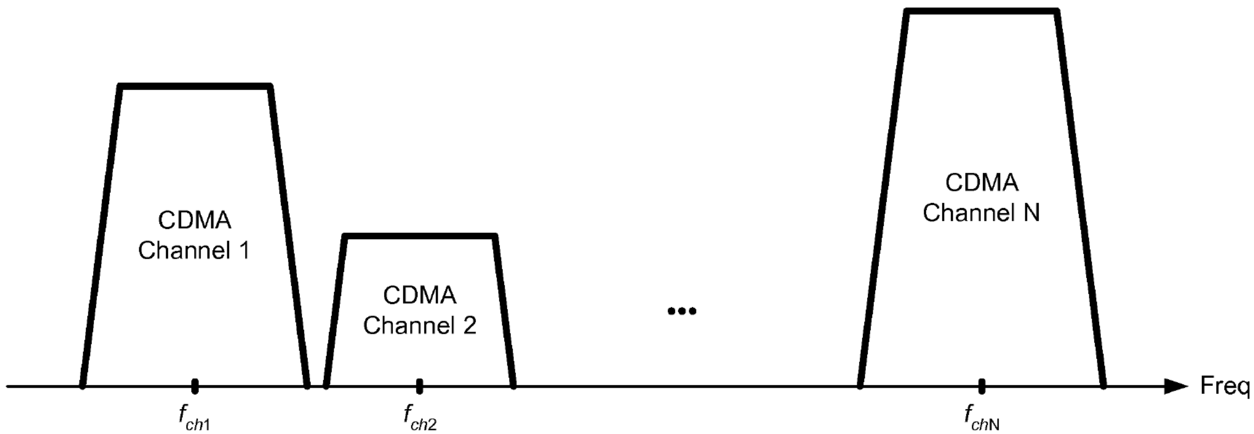
Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples,

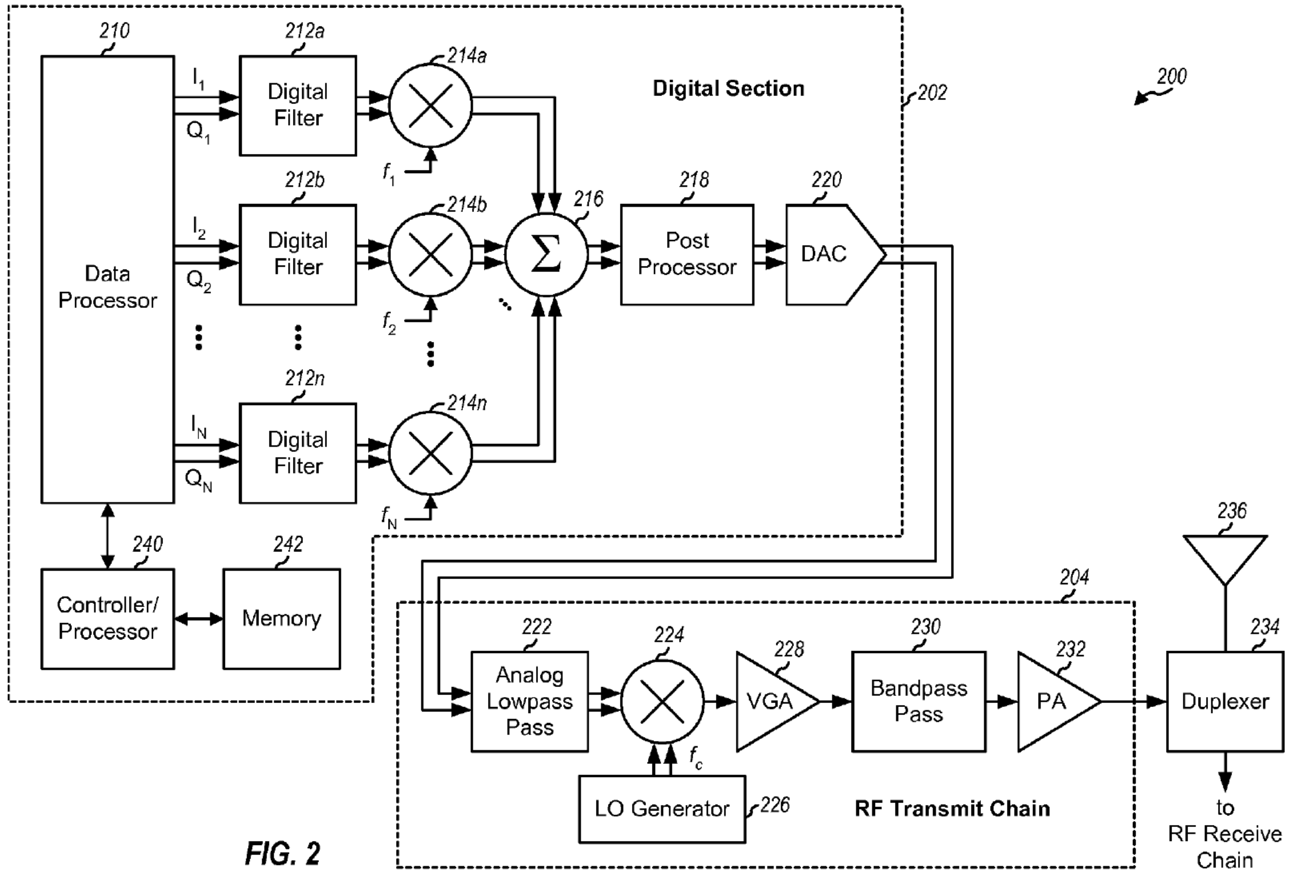
Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See, e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms “system” and “network” are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named “3rd Generation Partnership Project” (3GPP). cdma2000 is described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See, e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below.

Claim 24 of the '802 Patent	**Prior Art Reference – Rick**
	The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier (PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 1 *See, e.g.*, Rick at Figure 1.

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	 **FIG. 2** *See*, *e.g.*, Rick at Figure 2.

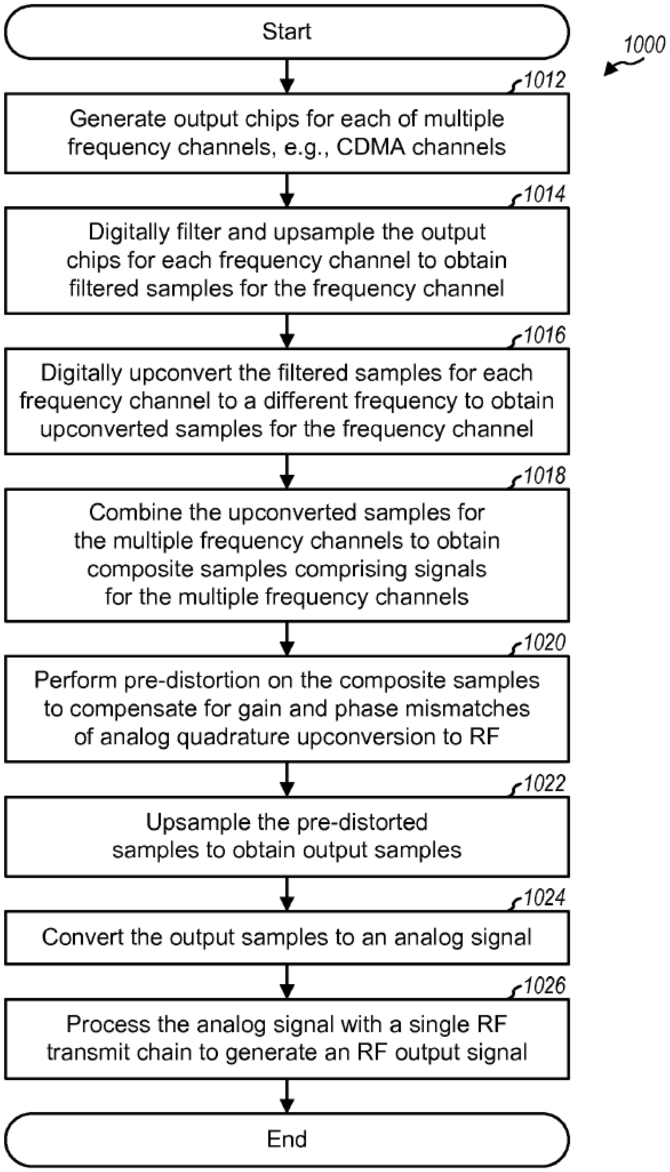

1000
Start
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 24 of the '802 Patent	**Prior Art Reference – Rick**
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.
[24.4] a filter having an input coupled to the output of the first down-converter and the output of the second down-converter, and in accordance therewith, the filter receives the first and second down-converted signals.	Rick discloses "a filter having an input coupled to the output of the first down-converter and the output of the second down-converter, and in accordance therewith, the filter receives the first and second down-converted signals." See, e.g.: A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously is described. In one design, the multi-carrier transmitter includes at least one processor and a single radio frequency (RF) transmit chain. The processor(s) may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q mismatch compensation, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband DAC. The RF transmit chain may process the analog signal to generate an RF output signal. *See, e.g.*, Rick at Abstract. Wireless communication systems are widely deployed to provide various communication services such as voice, video, packet data, messaging, broadcast, etc. These systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of

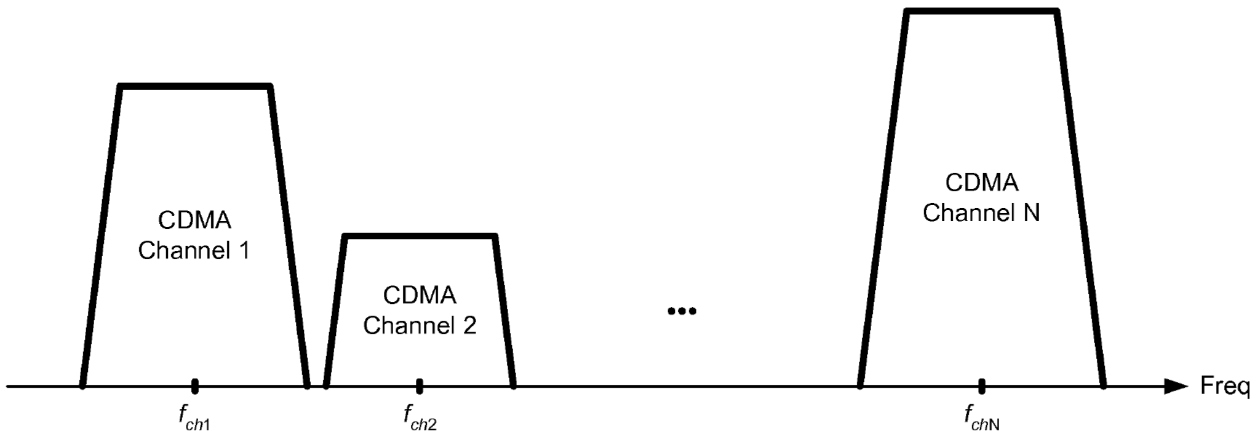
Claim 24 of the '802 Patent	Prior Art Reference – Rick
	such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems. Data usage for wireless communication systems continually grows due to increasing number of users as well as emergence of new applications with higher data requirements. A system may support a particular maximum data rate on one frequency channel under favorable channel conditions. This maximum data rate is typically determined by system design. To increase capacity, the system may utilize multiple frequency channels for transmission. However, the design complexity and cost of a transmitter may increase substantially in order to support transmission on multiple frequency channels. *See, e.g.*, Rick at 1:20-41. A multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously using a single radio frequency (RF) transmit chain is described herein. The single RF transmit chain may be wideband and designed for a particular maximum number of (T) frequency channels. Up to T signals may be transmitted simultaneously on up to T frequency channels using this single RF transmit chain. In one design, the multi-carrier transmitter includes at least one processor and one RF transmit chain. The processor(s) may generate output chips for each of multiple frequency channels in accordance with a particular system such as a High Rate Packet Data (HRPD) system. The output chips for each frequency channel may be scaled with a gain selected based on the transmit power for that frequency channel. The processor(s) may digitally filter and upsample the output chips for each frequency channel to obtain filtered samples and may digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples. The processor(s) may combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples to compensate for gain and phase mismatches of subsequent analog quadrature upconversion, and upsample the pre-distorted samples to obtain output samples. The output samples may be converted to an analog signal with a wideband digital-to-analog

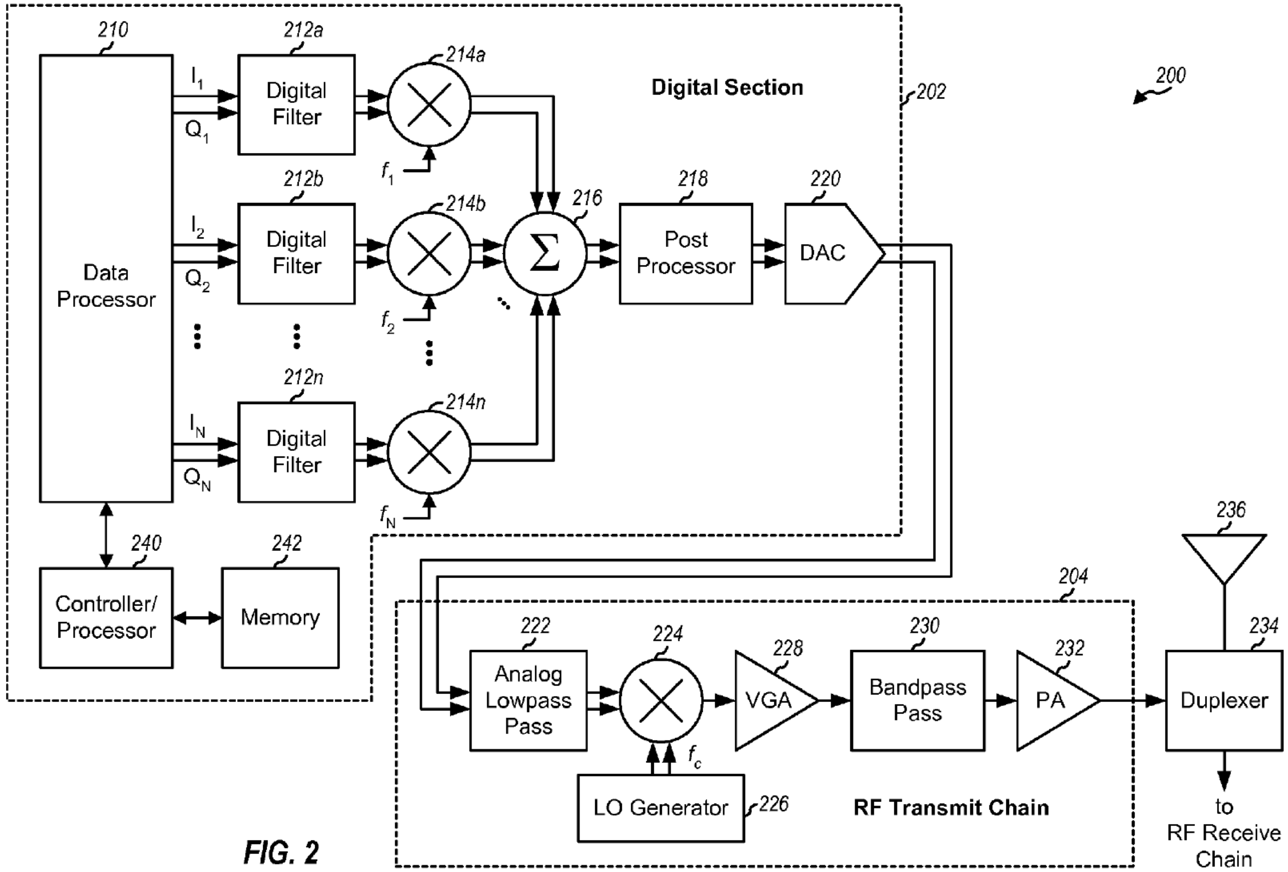
Claim 24 of the '802 Patent	**Prior Art Reference – Rick**
	converter (DAC). The RF transmit chain may then process (e.g., filter, quadrature upconvert, and amplify) the analog signal to generate an RF output signal. *See*, *e.g.*, Rick at 1:48-2:9. The multi-carrier transmitter described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, and SC-FDMA systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as cdma2000, Universal Terrestrial Radio Access (UTRA), etc. cdma2000 covers IS-2000, IS-95, and IS-856 standards. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), IEEE 802.11, IEEE 802.16, IEEE 802.20, Flash-OFDM®, etc. These various radio technologies and standards are known in the art. UTRA, E-UTRA, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 is described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). 3GPP and 3GPP2 documents are publicly available. *See*, *e.g.*, Rick at 2:38-57. The multi-carrier transmitter described herein may be used for an access terminal as well as an access point. An access point is generally a fixed station that communicates with the access terminals and may also be referred to as a base station, a Node B, etc. An access terminal may be stationary or mobile and may also be referred to as a mobile station, a user equipment (UE), a mobile equipment, a terminal, a subscriber unit, a station, etc. An access terminal may be a cellular phone, a personal digital assistant (PDA), a handset, a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. For clarity, the use of the multi-carrier transmitter for an access terminal is described below. The multi-carrier transmitter can transmit one or multiple CDMA signals simultaneously. Each CDMA signal may be sent on a different CDMA channel. A CDMA channel is a frequency channel

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	for one CDMA signal and is 1.2288 MHz wide in HRPD. A CDMA channel is also commonly referred to as a carrier. FIG. 1 shows an example transmission of N CDMA signals on N CDMA channels, where N ≧ 1 in general and N>1 for multi-carrier operation. In this example, CDMA channel 1 has a carrier frequency of fch1, CDMA channel 2 has a carrier frequency of fch2, and so on, and CDMA channel N has a carrier frequency of fchN. The carrier frequencies are typically selected such that the CDMA channels are spaced sufficiently far apart to reduce inter-channel interference. In general, the carrier frequencies of the N CDMA channels may or may not be related to one another. The carrier frequency of each CDMA channel may be selected independently subject to a minimum inter-channel spacing criterion. The carrier frequencies may be evenly spaced across frequency and separated by a fixed frequency spacing of fspacing, which may be 1.2288 MHz or some larger value. The N CDMA signals may be transmitted at different power levels (as shown in FIG. 1) or at the same power level. The N CDMA signals may carry any type of data for any service such as voice, video, packet data, text messaging, etc. The N CDMA signals may be sent to the same access point or to different access points. It is desirable to support transmission of one or multiple CDMA channels using as little circuitry as possible in order to reduce cost, lower power consumption, improve reliability, and obtain other benefits. T different RF transmit chains may be used to generate up to T CDMA signals for up to T CDMA channels, where T is the maximum number of CDMA signals that can be sent simultaneously. However, the T RF transmit chains may significantly increase the cost of an access terminal. *See, e.g.*, Rick at 3:1-47. Within digital section 202, a data processor 210 processes data, pilot, and control information and provides N output chip streams for N CDMA signals to N digital filter 212 a through 212 n. A chip is typically a complex value sent in one chip period, which is a time duration determined by a system. Each output chip stream may be at a chip rate (c×1), which is 1.2288 megachips/second (Mcps) for HRPD. Each digital filter 212 filters its output chip stream, performs upsampling, and provides a

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	filtered sample stream to a rotator 214. Each filtered sample stream may be at a sample rate of fsample. The sample rate may be fixed and selected based on the maximum number of CDMA signals that can be transmitted simultaneously. Alternatively, the sample rate may be configurable and selected based on the number of CDMA signals being transmitted simultaneously. Each rotator 214 operates as a digital upconverter, frequency upconverts its filtered sample stream with a digital local oscillator (LO) signal, and provides an upconverted sample stream. The digital LO signal for the CDMA signal sent on CDMA channel n has a frequency of fn, which is determined by the carrier frequency fchn of CDMA channel n and the frequency fc of an analog LO signal used for upconversion to RF. A summer 216 receives and sums the N upconverted sample streams from N rotators 214 a through 214 n and provides a composite sample stream. A post processor 218 performs post processing on the composite sample stream and provides an output sample stream. A DAC 220 converts the output sample stream to analog and provides an analog baseband signal containing the N CDMA signals. An RF transmit chain may implement a super-heterodyne architecture or a direct-conversion architecture. In the super-heterodyne architecture, a baseband signal is frequency upconverted in multiple stages, e.g., from baseband to an intermediate frequency (IF) in one stage, and then from IF to RF in another stage. In the direct-conversion architecture, which is also referred to as a zero-IF architecture, the baseband signal is frequency upconverted from baseband directly to RF in one stage. The super-heterodyne and direct-conversion architectures may use different circuit blocks and/or have different circuit requirements. The following description assumes the use of the direct-conversion architecture. Within RF transmit chain 204, an analog lowpass filter 222 filters the analog baseband signal from DAC 220 to remove images caused by the digital-to-analog conversion and provides a filtered signal. A mixer 224 frequency upconverts the filtered signal from baseband to RF with an analog LO signal from an LO generator 226. LO generator 226 may include a voltage controlled oscillator (VCO), a phase locked loop (PLL), a reference oscillator, etc. A variable gain amplifier (VGA) 228 amplifies the upconverted signal from mixer 224 with a variable gain. A bandpass filter 230 filters the signal from VGA 228 to remove images caused by the frequency upconversion. Bandpass filter 230 may be a surface acoustic wave (SAW) filter, a ceramic filter, or some other type of filter. A power amplifier

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	(PA) 232 amplifies the signal from filter 230 and provides an RF output signal having the proper power level. The RF output signal is routed through a duplexer 234 and transmitted via an antenna 236. As shown in FIG. 2, the signals from data processor 210 to mixer 224 are typically complex signals having inphase (I) and quadrature (Q) components. DAC 220 and RF transmit chain 204 may be wideband to support simultaneous transmission of N CDMA signals on N CDMA channels. DAC 220 may be operated at a sufficiently high clock rate and may have sufficient resolution for conversion of a digital sample stream containing all N CDMA signals. Analog lowpass filter 222 may have a fixed or variable bandwidth that may be sufficiently wide to pass all of the CDMA signals being sent simultaneously. The subsequent analog circuit blocks may also be wideband to pass all of the CDMA signals. Bandpass filter 230 may be wideband and may pass an entire frequency band, e.g., from 824 to 849 MHz for cellular band and from 1850 to 1910 MHz for Personal Communications Service (PCS) band. *See, e.g.*, Rick at 3:61-4:67. Multi-carrier transmitter 200 may be used in conjunction with a multi-carrier receiver that can receive one or more CDMA channels. Duplexer 234 may route an RF received signal from antenna 236 to the multi-carrier receiver, which is not shown in FIG. 2. The multi-carrier receiver may process the RF received signal to recover data and control information sent on one or more CDMA channels. *See, e.g.*, Rick at 5:24-30.

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	 **FIG. 1** *See, e.g.*, Rick at Figure 1.

Claim 24 of the '802 Patent	Prior Art Reference – Rick
	 FIG. 2 *See*, *e.g.*, Rick at Figure 2.

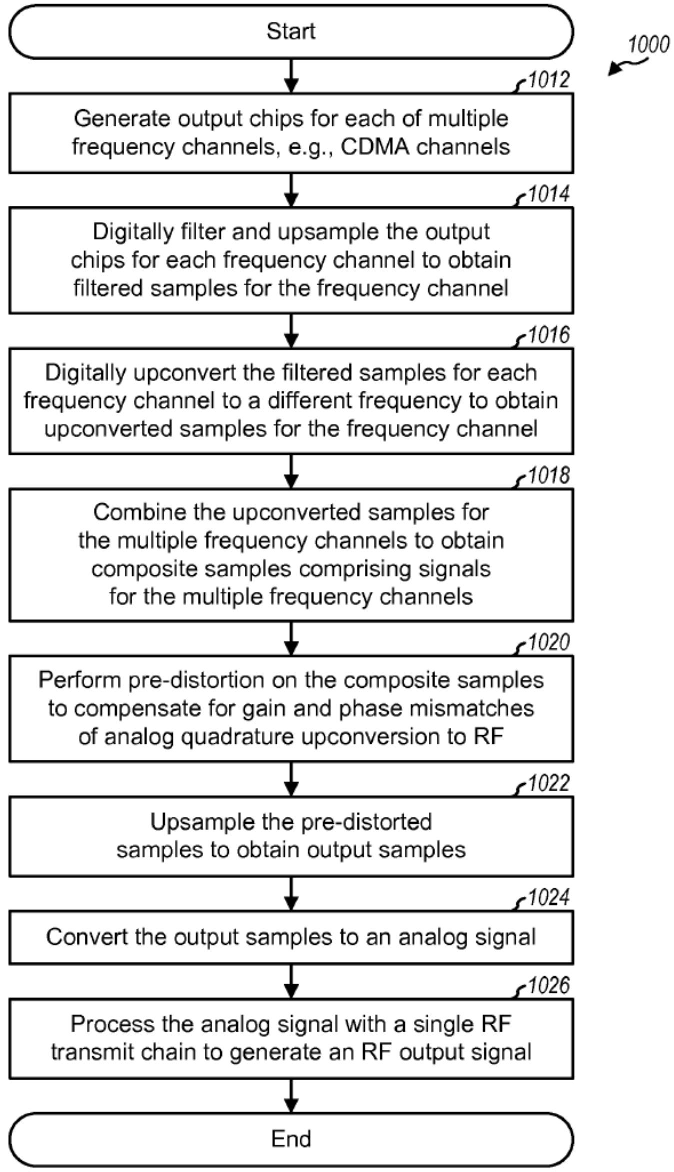

Start
1000
1012
Generate output chips for each of multiple frequency channels, e.g., CDMA channels
1014
Digitally filter and upsample the output chips for each frequency channel to obtain filtered samples for the frequency channel
1016
Digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples for the frequency channel
1018
Combine the upconverted samples for the multiple frequency channels to obtain composite samples comprising signals for the multiple frequency channels
1020
Perform pre-distortion on the composite samples to compensate for gain and phase mismatches of analog quadrature upconversion to RF
1022
Upsample the pre-distorted samples to obtain output samples
1024
Convert the output samples to an analog signal
1026
Process the analog signal with a single RF transmit chain to generate an RF output signal
End

FIG. 10

Claim 24 of the ’802 Patent	Prior Art Reference – Rick
	See, e.g., Rick at Figure 10. Furthermore, this claim element is obvious in light of Rick itself, when combined with any of the other references as charted for this claim element in Exs. A-1–A-31, First Supplemental Ex. A-Obviousness Chart, and/or when combined with the knowledge of one of ordinary skill in the art. Motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from the known problems and predictable solutions as embodied in these references. Further motivations to combine references and additional details may be found in the Cover Pleading and First Supplemental Ex. A-Obviousness Chart.